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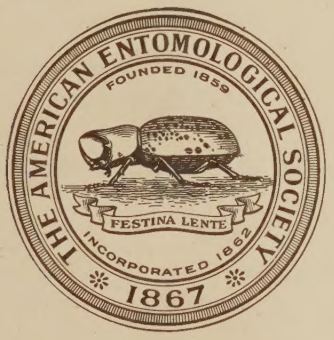

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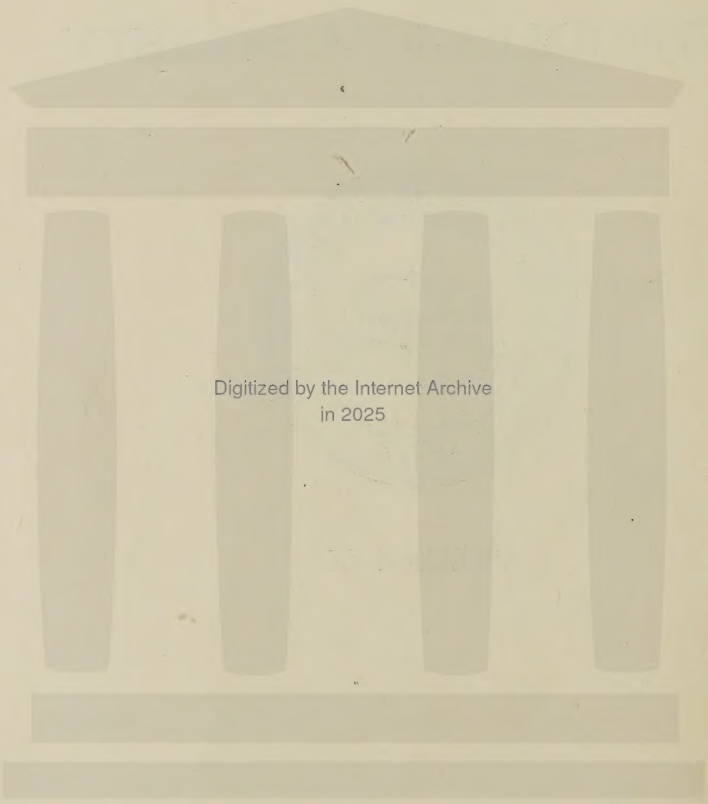
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TRANSACTIONS

OF THE

AMERICAN ENTOMOLOGICAL SOCIETY

VOLUME LI

THE GROUP TAENIOPODAE AS FOUND IN THE UNITED STATES (ORTHOPTERA)

BY MORGAN HEBARD

For the fauna of the United States, the Group Taeniopodae[1] comes first in the subfamily Cyrtacanthacrinae. It includes, in this region, only two species, *Romalea microptera* (Beauvois) and *Taeniopoda eques* (Burmeister), but these are among the largest and most strikingly colored grasshoppers belonging to this fauna.

The genera to which these species belong may be separated as follows:

A. Fastigium moderately declivent, apex formed by its raised lateral carinae not cut by sulcus of frontal costa. Tegmina with humeral and anal veins very conspicuous, heavy and raised. Wings with fenestrate areas opaque, of same color as disk of radiate field. Tegmina and wings much reduced, incapable of flight, not extending much beyond median portion of caudal femora. General structure, prosternal spine, limbs and spines of caudal femora somewhat heavier. (Southeastern United States.) ..... *Romalea* Serville

AA. Fastigium decidedly declivent, apex formed by its raised lateral carinae cut by sulcus of frontal costa. Tegmina with humeral and anal veins not as conspicuously heavy and raised. Wings with fenestrate areas moderately hyaline, not colored as disk of radiate field. Tegmina and wings not as much reduced,

[1] The "Tribe Romali," erected by Blatchley in 1920, has no value.

extending to near or beyond apices of caudal femora; in the male sex showing least reduction and in that sex of some species capable of sustained flight. General structure, prosternal spine, limbs, and spines of caudal femora slightly less heavy. (Extreme southern Texas, New Mexico and eastern Arizona to Panama.) ..... *Taeniopoda* Stål

All of the material mentioned in the present paper, unless otherwise noted, is in the Philadelphia Collections.

ROMALEA Serville

1831. *Romalea* Serville, Ann. Sci. Nat., XXII, p. 280.
1838. *Rhomalea* Burmeister, Handb. Ent., II, abth. II, pt. I, p. 619. (Emendation.)

For some time *Dictyophorus* Thunberg was the name used for this genus. Kirby's selection of *Gryllus spumans* Thunberg as genotype of *Dictyophorus*, in 1902,[2] definitely applies that name to the African genus of which *Petasia* Serville and *Tapesia* Bolivar are synonyms.

The genotype of *Romalea*, by monotypy, is *Acridium micropterum* Beauvois. Though numerous other specific names have been proposed, *Romalea* is a genus including but one species. It may be separated from the genus of nearest relationship, *Taeniopoda* Stål, by the characters given in the above key.

Romalea microptera (Beauvois) (Plate I, figure 1.)

1805. *Acridium micropterum* Beauvois, Ins. Rec. Afr. et Amer., p. 146, Orth. pl. IV, fig. 4. [♂, ♀; South Carolina.]
1813. [*Gryllus* (*Locusta*)] *guttatus* Stoll, Natuur. Afbeeld. Beschryv. Spooken etc., Trek-Springh., p. 23, pl. 10b, fig. 34, register p. 12. [♀, Georgia.]
1815. *D*[*ictyophorus*] *reticulatus* Thunberg, Mém. Acad. Imp. des Sci., St. Petersbourg, V, p. 259. [Western (in error) America.]
1838. *Rh*[*omalea*] *gigantea* Burmeister, Handb. Ent., II, abth. II, pt. I, p. 619. [♂, ♀; South Carolina.]
1839. *Romalea microptera* Serville, Hist. Nat. Ins., Orth., p. 622. [♂, ♀; Carolina.]
1839. *Romalea marci* Serville, ibid., p. 623. [♀, Near South Carolina.]
1842. *A*[*cridium*] (*Rhomalea*) *gigantea* Haan, Verh. Natuur. Geschied. Nederlandische Overzee. Bezitt., Ins., p. 143. [Tennessee.]
1842. *A*[*cridium*] (*Rhomalea*) *marci* Haan, ibid., p. 143. [Tennessee.]
1870. *Rhomalea centurio* Walker (not *Gryllus* (*Locusta*) *centurio* Drury, 1773), Cat. Dermapt. Saltat. British Mus., III, p. 537. (In part.) [St. John's Bluff, Florida.]
1870. *Rhomalea gigantea* Walker, ibid., p. 538. [Missouri (in error).]
1872. *Rhomalea microptera* Glover, Illustr. N. A. Ent., Orth., pl. III, fig. 4. (Colored figure of adult female.)

[2] Trans. Ent. Soc. London, 1902, p. 88.

1872. *Gryllus centurio* Glover (not of Drury, 1773), ibid., pl. III, fig. 4. (Colored figures of large and small immature individuals.)

1873. *R[homalea] centurio* Thomas (not *Gryllus* (*Locusta*) *centurio* Drury, 1773), Rept. U. S. Geol. Surv. Terr., Hayden, V, pt. I (Acrid. of North America), p. 179. [♂, ♀; Florida (with description of living material).]

1910. *R[homalea] gloveri* Kirby, Synon. Cat. Orth., III, p. 370. [Missouri (probably in error).]

1920. *Romalea microptera* Blatchley, Orth. of North-Eastern America, p. 304, fig. 111. (Valuable for references to recent literature and compilation of data as to habits.)

The synonymy of *gloveri* Kirby is evident and was established by Blatchley in 1920. Glover figured a female as *microptera* and two of the immature stages of this species as *centurio*. Kirby, mistaking the immature for a male, believed that two distinct species were there portrayed. The other synonyms listed above have all been previously established. The melanistic color phase, often developed, was responsible for the name *marci*. Thomas, in 1873, first suggested the probability that this phase did not represent a distinct species and this synonymy was definitely established by Rehn and Hebard in 1916.[3]

We have made no attempt here to include the numerous recent or the valueless older references to the species.

The coloration of the usual condition of this handsome insect is yellowish tawny or tawny, marked with blackish brown, the more conspicuous areas of which are as follows: more than distal half of antennae; suffusions laterad on vertex and occiput; sulci, lateral carinae and sides of medio-longitudinal carina of pronotum; (often) humeral and anal veins and numerous small intervals between veins and veinlets of tegmina; peripheral margin of wings, broadening cephalad; abdominal tergites heavily; abdominal sternites proximo-laterad, except male penultimate sternite, which is shining black proximad, with a broad medio-longitudinal band of the same color; genicular areas or only arches (broadly) of caudal femora, and streaks and flecks on limbs. The pronotum is often more yellowish at its caudal margin. The discoidal field of the tegmina is beautifully and delicately washed with peach red or rose doree, this clearest in the more recessive examples. The wings, except for the black peripheral margin and somewhat suffused costal marginal area, are clear and rich rose doree.

[3] Proc. Acad. Nat. Sci. Phila., 1916, p. 193.

Intensive individuals before us from Isle of Hope and Thomasville, Georgia, and Jacksonville, Florida, have the black markings and suffusions much more extensive, in some covering almost all of the pronotal dorsum.

A very distinctive melanistic phase occurs. It is found locally in South Carolina, Tennessee and northern Georgia, but has not been found in peninsular Florida. Along the wet portions of the Gulf Coast, however, it occurs east to Apalachicola, Florida, and westward in that area wholly supplants the normal condition, though in the drier portions of eastern Texas the normal coloration alone is found.

This melanistic phase is solidly black except for the normally colored wings and the following markings of buffy yellow. A medio-longitudinal line on head and pronotum; a large portion of the lateral facial carinae and the ventro-caudal margin of the genae; a broad marginal band on the caudal margin of the pronotal lateral lobes, which narrows in the discal portion; a medio-longitudinal and lateral marginal bands on the abdominal tergites; the ventral carinae of the external pagina of the caudal femora and the proximal portions of their dorsal and ventral carinae. The abdominal sternites, except the two ultimate, are margined distad with yellowish tawny.

This coloration is an exact replica of the immature marking, the early stages having the pale markings orange or yellow, the black with a metallic greenish luster. Though the melanistic strain may have Mendelian significance, we believe that it is more probably due to local environmental influences.

In rare melanistic individuals a faintly pink area is sometimes indicated in the discoidal field of the tegmina. In the species *Taeniopoda eques* (Burmeister) and *Taeniopoda varipennis* Rehn, single similarly melanistic males have been recorded by us.[4]

The great size diversity occasionally encountered in this species appears to have no geographic significance.

[4] Trans. Amer. Ent. Soc., L, pp. 258 and 272, (1925).

Measurements (in millimeters)

♂	Length of body	Length of pronotum	Greatest width of pronotal disk	Length of tegmen	Width of tegmen	Length of caudal femur
Columbia, South Carolina...	52.3	15.6	7.5	23.5	8.4	27.7
Thomasville, Georgia.....	51.7	16	7.8	29	8.7	29.8
Pablo Beach, Florida.....	55.2	17.1	9	31.5	9.9	33.7
Fort Myers, Florida.....	42.2	13.1	6.8	17	6.2	24.8
Fort Myers, Florida.....	53	16.2	7.2	23.7	8.1	28.8
Florida City, Florida.....	55.7	17.2	8.2	22.9	9	31.1
Mobile, Alabama.....	55.7	16.7	9	27	10	29.3
Spanish Fort, Louisiana....	45.5	16	7.7	22.7	8.7	26.9
Spanish Fort, Louisiana....	59.7	18.9	8.8	29.2	10.8	33.8
Rosenberg, Texas.....	55.8	17.7	8.9	23.9	9.2	29
♀						
Isle of Hope, Georgia.....	64	19	10	29.9	10.2	30.5
Thomasville, Georgia.....	69.5	20	10.3	31	11.7	35
Pablo Beach, Florida.....	78	23.2	11.3	31.9	12	36
Fort Myers, Florida.....	54.3	15.8	8.4	22.4	8.3	25.8
Fort Myers, Florida.....	67.5	17.8	9.3	28.9	10.4	31.3
Ritta, Florida.....	85	24.7	12.3	41	12.6	39.6
Mobile, Alabama.....	67	19.1	10.2	29	11.2	30.8
Spanish Fort, Louisiana....	49.8	14.1	7.8	18.2	6.9	23.3
Spanish Fort, Louisiana....	79	22.7	11.9	33.2	13	34.5

Numerous and generally distributed in Florida (not including the Keys), this insect occurs westward along the Gulf Coast as far as Victoria, Texas. The known northern limits of its distribution are Cabarrus County, North Carolina; Lookout Mountain, Tennessee; Tuscaloosa and Huntsville, Alabama; Hattiesburg, Mississippi, and Palestine, Texas.[5]

Bruner, in 1907, states for *micropiera* that "there is but little doubt that the distribution includes northern Mexico.....". From field observations we now know definitely that the insect does not occur southwestward as far as the Mexican boundary.

Clumsy and incapable of flight, these large insects would fall an easy prey to the multitude of grasshopper enemies, were they not securely protected by a secretion so offensive that, we are told, even chickens can not be induced to eat them.

[5] We do not recognize as valid Walker's "Missouri" record. The insect is not native in that state and the record is based either on an introduction or incorrectly labelled material.

This brown fluid is exuded from the thoracic spiracles by contractions of the abdomen, if an individual is seized. It escapes as a bubbly froth, at each contraction of the abdomen making a decided hissing sound. Such protection is apparently peculiar to all the species of the present group.

At Spanish Fort, Louisiana, on a hot, sunny day, we found the males constantly courting. Approaching the females cautiously, they would then suddenly spring at them with surprising agility. When grasping a female, the males, with tegmina raised, cause the wings to flutter for brief though frequent periods, jerking their bodies at the same time from side to side. This is done before and during coition and a very few females were also seen to indulge in similar antics.

Specimens Examined, in addition to 92 previously recorded: 267; 158 males, 97 females and 12 immature individuals.

GEORGIA: Groveland, IX, 21, 1917, (Hebard; very few in sandy forested land near river), 1 ♂. Bainbridge, IX, 5, 1915, (Rehn; in undergrowth of long-leaf pine woods), 1 ♂.

FLORIDA: De Leon Springs, IX, 8 and 9, 1917, (Rehn and Hebard; among low plants on sandy soil), 1 ♀. Ocala, IX, 19 and 20, 1917, (Rehn and Hebard), 1 ♀. Kissimmee, IX, 9 and 10, 1917, (Rehn and Hebard), 1 ♀. Lakeland, IX, 11, 1917, (Rehn and Hebard; in dry grassy area), 1 ♀. Tampa, V, 31, 1921, (Hebard; in garden in city), 1 ♂, 2 ♀, 1 juv. Useppa Island, Lee County, V, 19, 1919, (Hebard), 1 juv.; V, 29, 1921, (Hebard; in sandy garden), 1 ♂. Fort Myers, IX, 13 to 15, 1917, (Rehn and Hebard; in marsh plants along railroad and one colony on Beautiful Island in Caloosahatchee River, the majority very old specimens), 3 ♂, 10 ♀. Ritta, Lake Okeechobee, X, 1918, (W. R. Robbins), 1 ♂. Everglade island two miles west of Muck, Dade County, III, 2, 1919, (Hebard; colony climbing about in fresh young shoots of undergrowth), 5 juv. Royal Palm Key, Dade County, III, 3, 1917, (Hebard), 1 small juv.; IV, 7, (J. N. Knull), 1 ♀. Woodville, Leon County, IX, 1, 1915, (Rehn and Hebard; few in undergrowth of long-leaf pine forest), 5 ♂, 4 ♀. River Junction, Gadsden County, VIII, 31, 1915, (Rehn and Hebard), 2 ♂.

ALABAMA: Millerville, Clay County, VII, 16, 1900, (Pollard), 1 ♀, (melanistic), [U. S. N. M.]. Huntsville, 1 ♀. Mobile, VIII, 26 and 27, 1915, (Rehn and Hebard; on edge of cane brake), 1 ♂, 1 ♀, (melanistic); (Dr. Corson), 1 juv.

MISSISSIPPI: Biloxi, Harrison County, IV, 27, (F. M. Jones), 2 small juv.

LOUISIANA: New Orleans, VIII, 5, 1915, (Rehn and Hebard; abundant on drained swamp land), 1 ♂, 1 ♀, (all melanistic). Spanish Fort, Lake Pontchartrain, V, 5, 1915, (Rehn and Hebard; very common in rather large local areas of marsh with high grass, mallows, some saw-palmetto and willows,

when present ubiquitous, even up in small willows as high as ten feet from ground), 133 ♂, 70 ♀, 1 juv. ♀, (all melanistic). Morgan City, VIII, 8, 1915, (Rehn and Hebard; very few in heavy, low vegetation, on edge of swamp), 2 ♂, 2 ♀, (melanistic).

Texas: Houston, VIII, 12, 1915, (Rehn; very few in almost flat country, with oak groves and some pine), 1 ♂, 1 ♀. Harrisburg, near Houston, VIII, 13, 1915, (Rehn and Hebard; in high grasses along railroad), 1 ♂. Palestine, VIII, 16, 1915, (Hebard; found perched in post oak at night), 1 ♂. Webster, Harris County, VII, 19, 1912, (Hebard; one only on almost bare black muck of flat open country), 1 ♂. Dickinson, Galveston County, VII, 20, 1912, (Hebard; one only in low green grassy spot in pine woods), 1 ♂. Rosenberg, Fort Bend County, VII, 25 and 26, 1912, (Hebard; in low and very heavy growth of grasses), 1 ♂.

TAENIOPODA Stål

1873. *Taeniopoda* Stål, Recensio Orth., I, p. 50.

The genotype is *T. picticornis* (Walker),[6] an insect very closely related to *T. eques* (Burmeister). The former may, indeed, represent a geographic race of the latter, but no evidence is as yet available to warrant its recognition as such.[7]

In a recent revision of the genus[8] we have recognized eleven species, which divide into three groups. The majority of these are found in Mexico, but the genus occurs from near the Mexican border in the western United States south to Panama.

Taeniopoda eques (Burmeister) (Plate I, figure 2.)

1838. *Rh[omalea] eques* Burmeister, Handb. Ent., II, abth. II, pt. I, p. 620. [♂, ♀; Zimapan, [Hidalgo], Mexico.]

1901. *T[aeniopoda] burmeisteri* Bolivar, Bull. Soc. Española Hist. Nat., I, p. 266. [♀, Mexico.]

1903. *Taeniopoda picticornis* Caudell, (not *Rhomalea picticornis* Walker, 1870), Proc. U. S. Nat. Mus., XXVI, p. 795. [Base of foothills of Guadalupe Mountains [Culberson County, Texas].]

1907. *Taeniopoda picticornis* Bruner, (not *Rhomalea picticornis* Walker, 1870), Biol. Cent.-Amer., Orth., II, p. 234, pl. II, fig. 17. [♂, ♀; southern Arizona; Lerdo, Durango and Mesquitic, Jalisco, Mexico.]

We have recently discussed *eques*, the synonymic name *burmeisteri* and the confusion in past literature with *picticornis* and *ståli*.[9] This species is the only one of the genus *Taeniopoda*

[6] Selected by Rehn, Proc. Acad. Nat. Sci. Phila., 1904, p. 530, (1904).
[7] See Hebard, Trans. Amer. Ent. Soc., L, pp. 258 and 260, (1925).
[8] Trans. Amer. Ent. Soc., L, pp. 253 to 274, (1925).
[9] Trans. Amer. Ent. Soc., L, pp. 256-258, (1925).

whose distribution reaches the United States, the other ten species recognized by us being found to the south, as far as Panama. It occurs only in the Big Bend region and extreme western Texas and along the Mexican border in New Mexico and the eastern portion of Arizona. Though widely distributed over the Mexican table-land, *eques* is not found north of Tepic on the Pacific coast.

The striking coloration for the normal phase of this insect in the United States is as follows. Head, pronotum, base of tegmina and body black, the head and pronotum marked with bright yellow in the following places; greater portion of face, broad caudal portion of genae and occiput and caudal margin of pronotum, this latter slightly and gradually widening ventrad so that its inner margin terminates meso-caudad on the ventral margin of the lateral lobes; also a medio-longitudinal band which is usually bright orange, narrow on pronotum and broad on head. Antennae with first two and the distal joints black, the remaining joints cadmium orange, each very narrowly black at its distal extremity. Tegmina with veins and veinlets (except in dark proximal and distal portions) rivage green, the intervals between solidly black; apices in males very broadly, in females narrowly suffused with black, rarely with a very narrow green margin.[10] Wings with anterior and first sector of radiate field black distad and suffused with black proximad, an area before the marginal dark portion (large in males, small in females) with intervals between veins and veinlets geranium pink; remaining portions of radiate field geranium pink, with a black margin which is narrow caudad but gradually widens, becoming very broad toward the anterior field. Abdominal tergites black with a medio-longitudinal and a marginal band on each side of yellow (often very weak in males). Ventral surface ranging from yellowish buff to black, but with subgenital plate of all males black. Cephalic and median limbs black, with varyingly prominent longitudinal stripes of yellow or orange. Caudal coxae black with a large external area of bright yellow. Caudal femora black, but with all ex-

[10] This feature is decidedly more prominent in a few Mexican examples before us.

posed carinae and pattern of external pagina defined in yellow; genicular areas, however, solidly black. Caudal tibiae black, but with dorso-external margin often buffy orange.

In the United States color variation is by no means as decided as in Mexico.[11] Intensification causes the black portions to be more extensive in some series, while with recession these areas become less, with brown or some yellow showing through. A very few individuals in the large series before us have the dark portions of the head and pronotum tan color instead of black, in the majority of these showing a suffusion of black toward the medio-longitudinal pale line.[12]

The immature condition is colored almost exactly as in *Romalea microptera*),[13] except that the dorsal carina and external pagina of the caudal femora are more generally yellowish buff.

Size variation in this insect is apparently due very largely to local environmental influences. It is interesting to note that near Espinosa Rancho, Arizona, on the rather sterile mimosa-covered flats of the Altar Valley, the insects were very numerous but averaged small and in a few cases were much the smallest we have ever seen. A few miles away, toward the mountains, at the lower end of Sycamore Wash, the species was much less numerous but individuals averaged decidedly larger. In the foothills of the nearby Baboquivari Mountains, however, though few in number, individuals of *eques* showed decidedly the optimum development. Such has also been found true by us of other species found in a semi-desert foothill environment. The vegetation is such localities is often no heavier generally than on flats, though in both types of environment local areas of unusual luxuriance can, as a rule, be found. Thus we feel satisfied that the size in *eques* is almost wholly governed by local influences, probably due, in large part, to the abundance combined with the luxuriance of certain food plants to be found in such areas.

[11] See Hebard, Trans. Amer. Ent. Soc., L, p. 257, (1925).

[12] Several specimens before us from northern Mexico show similar coloration, as apparently did Burmeister's type of the species.

[13] See page 4.

Measurements (in millimeters)

♂	Length of body	Length of pronotum	Caudal width of pronotal disk	Length of tegmen	Width of tegmen	Length of caudal femur
Garden Spring, Texas[14]	43	12.7	7.3	30.2	8.7	21.9
Garden Spring, Texas	46.2	13.8	8.6	39.2	10	22.3
Lost Mine Peak, Texas	49.5	14.9	9	43.1	11.8	23.7
Hachita Grande Mountains, New Mexico	45	14.7	8.7	41.8	11.3	24.1
Perilla Mountains, Arizona	50.7	14.9	8.4	46	12.2	25.9
Naco, Arizona[14]	43	12.9	7.2	28.8	7.9	22.8
Naco, Arizona	52.7	16.4	8.8	43.9	12	25
Espinosa Rancho, Arizona[15]	38.8	12.7	6.8	25	6.2	20.7
Espinosa Rancho, Arizona	50	15	8.8	44.5	11.5	26.2
Sycamore Wash, Arizona[16]	48.3	14.7	8.3	33.4	8.4	25.3
Sycamore Wash, Arizona	51.2	15.7	9	46.7	12.4	26.7
Sycamore Canyon, Arizona[16]	52	15.7	8.8	41.2	10.7	27.2
Sycamore Canyon, Arizona	53.4	16.3	10	45.8	11.2	25.4
♀						
Garden Spring, Texas[17]	49.2	14	8.7	26.4	6.9	21
Garden Spring, Texas	62.8	17.8	10.1	37.2	10.2	26
Pulliam Bluff, Texas	56.4	16.7	10	33.2	9.2	25.2
Naco, Arizona[18]	55.8	16.8	9	27.7	7.2	22.3
Naco, Arizona	67.3	18.8	10.9	36.3	10.2	28.8
Espinosa Rancho, Arizona	40.9	13.1	7.4	23	6.2	19.4
Espinosa Rancho, Arizona	59.9	17.7	10.9	36.2	10	27
Sycamore Wash, Arizona	53.3	16.1	9.7	31.3	8.8	24.8
Sycamore Wash, Arizona	57.3	18	11	35.7	10	27
Sycamore Canyon, Arizona	70.5	22	11.2	42.9	11.2	29

The species is usually very local in distribution. Often miles of apparently favorable territory within its range will be covered without one being seen. Then, in a small area many will be found, usually perched, apparently insecurely, on the stems and twigs of acacia or mesquite. Individuals with sufficient wing surface to enable flight, in the air progress with a slow fluttering, but frequently cover considerable distances. Those with longest wings would occasionally fly clumsily, the others not at all.

Plate II, figure 2, was taken on a plain of foot-high yellow gramma grass, with mesquites and a variety of small bushes and low cover, near Espinosa Rancho. The species was there usually

[14] Average of series slightly below half-way between extremes.
[15] Average of series decidedly below half-way between extremes.
[16] Average of series near maximum of extremes.
[17] Average of series about half-way between extremes.
[18] Average of series slightly above half-way between extremes.

in the mimosa and bushes, sometimes high up in the former, occasionally crawling slowly over the ground. Frequently seven or eight would be seen perched in one mimosa. When approached and seized they were easily taken, but if missed would drop heavily to the ground and, for so ponderous an insect, crawl very nimbly back to their bush. These multitudes were present in the Altar Valley from about two miles north of the Espinosa Rancho boundary to the foothills of the Baboquivari Mountains, eight miles southwestward, though abundant only in the park-like country. Some bushes there would have a great predominance of females, but further on these would be greatly outnumbered by the males.

When seized both sexes emit a hissing sound, somewhat suggestive of that made by a horse when drinking. This is caused by forcing air through glands which secrete a brown fluid, resulting in the ejection of a sticky froth that is undoubtedly highly distasteful to creatures which might otherwise devour these large and conspicuous insects. This act is apparently brought about by contractions of the abdomen.[19]

Specimens Examined: 314; 153 males, 131 females and 20 immature individuals.

Texas: Marathon, Brewster County, 4160 feet, IX, 11, 1912, (Rehn and Hebard; one in small hills one mile south of town, seen in very small numbers in and about the bushes on the plain from this point to Garden Spring), 1 ♂. Garden Spring, Brewster County, IX, 2 and 11, 1912, (Rehn and Hebard; fairly common on hillside and down near stream course, in cat-claw, mesquite and other bushes and clumsily crawling over ground), 71 ♂, 30 ♀, 6 juv. Glen Springs Road at Tornillo Creek, Brewster County, VII, 21, 1921, (C. D. Duncan; quite common in *Acacia*), 2 ♀. Moss Well, Chisos Mountains, 4700 feet, IX, 5 to 8, 1912, (Rehn and Hebard), 3 juv. Canyon behind Pulliam Bluff, Chisos Mountains, 4800 to 5000 feet, IX, 7, 1912, (Rehn and Hebard), 1 ♂, 2 juv. Lost Mine Peak, Chisos Mountains, 5500 feet, IX, 6, 1912, (Rehn and Hebard; a few immature individuals were seen on the steep slopes up to 6000 feet), 1 ♂. Texas, 1 ♂, [U. S. N. M.].

New Mexico: Pratt, Hidalgo County, 4400 feet, IX, 26, 1922, (Hebard; one female seen on mimosa from train). Sheridan Canyon, Hachita Grande Mountains, (H. A. Pilsbry), 1 ♂, 1 juv. ♀.

Arizona: San Carlos, (Wheeler's Expedition), 1 ♀, [U. S. N. M.]. Clifton, Greenlee County, (Davidson), 1 ♂, [U. S. N. M.]. Rock House Canyon, Dos Cabezos Mountains, Cochise County, 4450 feet, X, 14, 1910, (Hebard;

[19] See Duncan, Pan Pacific Ent., I, p. 42, (1924).

only specimen seen, which flew across a rocky ravine near a foothill summit), 1 ♂. San Bernardino Rancho, Cochise County, 3900 feet, IX, 24, 1922, (Hebard; a few in bushes on alluvial slopes, lower benches and hillsides), 1 ♂. South end of Perilla Mountains, Cochise County, 4500 feet, IX, 24, 1922, (Hebard; on ground near bushes on hillside), 1 ♂. Osborn, Cochise County, 4650 and 4700 feet, IX, 23, 1922, (Hebard; one in low mesquites on plain bordering sandy area of yuccas and one in black brush), 2 ♂. Naco, Cochise County, 4590 feet, IX, 23 and 24, 1922, (Rehn and Hebard; moderately common locally in mesquite bushes about town, the majority in low bushes, possibly due to the fact that a high wind was blowing), 20 ♂, 20 ♀. Fort Huachuca, Cochise County, 3 ♀, [U. S. N. M.]. Reddington, Pima County, 1 ♀, [U. S. N. M.]. Tucson, Pima County, 1 ♂, [U. S. N. M.]; X, 2, 1921 and X, 20, 1919, 2 ♂, 2 ♀, [Univ. of Arizona]. Near Coyote Indian Village, Santa Rosa Valley, Pima County, about 3000 feet, VIII, 13, 1916, (Rehn; juv. numerous on ground), 8 juv., [A. M. N. H. and A. N. S. P.]. Southeastern foothills of Pajaritos Mountains, Santa Cruz County, about 4300 feet, IX, 21, 1922, (Rehn and Hebard; near summits of rolling gravelly hills with very little cat-claw and mesquite), 1 ♂.[20] Palo Alto Rancho, Altar Valley, Pima County, about 3000 feet, X, 6, 1910, (Rehn and Hebard), 1 ♂. Near Espinosa Rancho, Altar Valley, Pima County, about 3200 feet, X, 6 and 9, 1910, (Rehn and Hebard; see notes above), 29 ♂, 68 ♀. Lower end of Sycamore Wash, Altar Valley, Pima County, about 3400 feet, X, 6 and 9, 1910, (Rehn and Hebard), 10 ♂, 2 ♀. Sycamore Canyon, Baboquivari Mountains, Pima County, 3700 to 4200 feet, X, 6 and 8, 1910, (Rehn and Hebard; a few in bushes on alluvial slopes and on lower benches and hillsides), 6 ♂, 1 ♀. Arizona, (G. W. Dunn), 1 ♀[21], [Hebard Cln.].

EXPLANATION OF PLATES

Plate I

Fig. 1. *Romalea microptera* (Beauvois). Dorsal view of male. Pablo Beach, Florida. (Slightly enlarged.)

Fig. 2. *Taeniopoda eques* (Burmeister). Dorsal view of male. Palo Alto Rancho, Altar Valley, Pima County, Arizona. (Slightly enlarged.)

Plate II

Fig. 1. Wash of Sycamore Canyon, looking westward toward Baboquivari Peak. Pima County, Arizona. Habitat of *Taeniopoda eques* (Burmeister) and many other interesting species.

Fig. 2. *Taeniopoda eques* (Burmeister), in acacia near Espinosa Rancho, flats of the Altar Valley. Pima County, Arizona.

[20] This specimen, attempting to fly across the road at the approach of our automobile, was crushed.

[21] Recorded by Bruner as *picticornis*.

SOME UNDESCRIBED MICROLEPIDOPTERA AND NOTES ON LIFE HISTORIES

BY ANNETTE F. BRAUN

Cincinnati, Ohio

Phthorimaea sacculicola new species

Palpi whitish, second segment dusted with fuscous-tipped scales outwardly and beneath, third segment with a very narrow nearly black line around its outer and lower side almost at base, a broad dusted annulus above its middle, and extreme tip black. Antennae creamy white, with fuscous annulations. Face creamy white, head above and thorax sparsely dusted with pale fuscous. Ground color of the fore wings creamy, overlaid with dull ocherous and fuscous scales, the former in longitudinal streaks between the veins, the latter in some places grouped into ill-defined spots and patches. A small round spot in the middle of cell and a larger elongate spot at end of cell, surrounded by dull ocherous scales; three ill-defined elongate patches of fuscous-tipped scales in a line from base to middle of wing below costa; a long wedge-shaped patch from near base to beyond middle above the fold, broken with dull ocherous scales in the middle; above and beyond this wedge-shaped patch and nearly parallel to termen, two more elongate indistinct fuscous patches, sometimes connected. All of these patches contrast little with the general wing color, which is everywhere dusted with similar fuscous scales. Hind wings and cilia pale brownish fuscous. Legs pale, dusted with fuscous scales, tips of tarsi cream-colored.

Expanse: 12–12.5 mm.

Type (♂) and two paratypes reared from miners in leaves of goldenrod (*Solidago* sp.), Cincinnati, Ohio.

The mine, which is somewhat inflated, with parenchyma entirely consumed, begins near the midrib, at first enlarging funnel-formed, later becoming an elongate blotch which occupies nearly half the leaf. The silken cocoon is spun outside the mine.

Mines collected May 31; imagoes June 21.

One specimen, taken on the wing, and dated April 17, seems to be of the same species.

Phthorimaea polemoniella new species

Palpi ocherous, dusted externally with brownish gray. The tip of the second segment, a rather indistinct annulus around the middle of the third segment, and the extreme tip of the third

segment are undusted and ocherous. Thorax and fore wings clothed with mingled brownish ocherous and white-tipped black or dark fuscous scales; a longitudinal ocherous streak within the costa from base to near middle; sometimes a fine ocherous line along fold; a broad ocherous streak from near middle to end of cell and on it an elongate black spot in the middle of the cell and a second at the end of the cell. Cilia gray. Hind wings and cilia gray, bases of cilia ocherous; no costal hair-pencil in the male. Legs whitish ocherous, densely dusted with fuscous; tips of segments whitish. Expanse: 10–11 mm.

Type (♂) and two paratypes (♂ and ♀), from larvae mining leaflets of Greek valerian (*Polemonium reptans*) at Eastwood, Brown County, Ohio. Type and paratypes in the writer's collection.

Several mines are made by a single larva. On entering a leaflet, all of the lower epidermis is separated before the larva begins to feed, and the mine is inflated and balloon-like. Later, most of the parenchyma is consumed, leaving only the whitish epidermis; the leaflet finally shrivels. Larvae collected July 20 produced moths August 9 to 11; the date of the type is August 9.

Allied to *P. axenopis* Meyrick (*artemisiella* Kearfott), but a much darker species and distinguished by the presence of only two dark spots on the fore wing.

I have here followed Meyrick in including in *Phthorimaea* not only those species with the costal hair-pencil on the hind wing of the male, but also those closely allied forms which do not possess this hair-pencil.

Ethmia zelleriella Chambers

The larvae were found feeding exposed on the upper surface of leaves of *Phacelia bipinnatifida*, near Cincinnati, August 15. Most of the larvae had molted for the last time; but a few were preparing the silken hammock in which the last molt takes place. This is a tubular web of very fine silk, stretched across the upper surface of a leaf, and bending it together a little. The web is about 2 cm. long between points of attachment, and 6 or 7 mm. in diameter where the larva lies. Beneath the larva a denser mat attaches the web more firmly to the leaf.

The full grown larva is a brightly colored and beautiful creature. The ground color is chrome yellow, marked with

velvety black spots and irregular longitudinal black or bluish black stripes and bands. Each tubercle area is black (as described and figured by Busck in the life history of *Ethmia macelhosiella*)[1] and there is, in addition, a longitudinal dorsal series of black spots, beginning on the second abdominal segment and consisting in each segment of an elongate spot crossing the suture, and a larger round spot in the middle of the segment. The longitudinal stripes are not so deeply black, and shade to bluish where they run into the chrome ground color. A subdorsal longitudinal stripe extends the length of the body and includes the setal areas above the spiracles and the spiracles also behind the second abdominal segment; setal area I lies just outside its boundary. There is an oblique lateral backward projection from this stripe in each segment beginning with the second abdominal. On the second thoracic segment, the stripes are connected across the dorsum between setal groups I. The third thoracic segment, except a small anterior lateral patch, and the anterior half of the first abdominal segment are black. A more or less broken grayish black stripe extends the length of the body and includes in each segment the black spot around seta VI. Legs black. Head shining black, with yellow transverse band.

When the larvae were ready to pupate, they were given pieces of corky bark of elm (*Ulmus racemosa*), into which they bored, forming pupal chambers as described by Busck for *Ethmia macelhosiella.*

A single moth emerged September 3 of the same year; the rest remaining in the pupal state until spring, and emerging from April 16 to 18. At this season of the year, they may often be seen resting on the tree trunks.

Lithocolletis diaphanella Frey and Boll

The mines of this southern species were found quite plentifully on leaves of swamp white oak (*Quercus bicolor*), in Clinton County, Ohio, on July 27, and a number of moths emerged from August 2 to 7. Mines of a later generation were collected in the same localities on September 29.

The mine resembles that of *L. basistrigella*, but is smaller and the epidermis is a little more wrinkled, so that the leaf is slightly bent; the parenchyma is entirely consumed, and the

[1] Proc. Ent. Soc. Wash., 24, pp. 1–9, (1922).

mine is transparent. The pupa lies within an oval, but incomplete ring of frass, the ring open at one end, thus differing from the very similar cocoon of *L. basistrigella*. The ring connects the upper and lower epidermis and the pupal chamber thus formed is silk-lined.

The species was originally described from Texas, and there is a specimen in the United States National Museum from that locality. One specimen in my own collection was reared on white oak from Winnfield, Louisiana. The northern specimens are a little darker in ground color, with more distinct dark margins to the streaks; the upper edge of the basal streak is also dark margined; a distinct line of black scales extends along the fold between the first and second dorsal streaks; a silvery spot within the margin interrupts the patch of black scales extending from the apex of the second dorsal streak to the termen and apex.

Tischeria admirabilis new species

Head dark bronzy fuscous; antennae fuscous, whitish in the apical half; thorax dark bronzy fuscous. Fore wing at base and below fold brilliant golden; the wing shades outwardly through brilliant bronzy red and purple tints to a deep shining blue around the apex and along termen; the deep blue scales are tipped with gold. Cilia gray. Hind wings and cilia gray, with a faint purple luster. Legs gray, tarsi yellowish. Expanse: 6–8 mm.

Type (♂) and six paratypes, all reared from larvae mining leaves of *Rosa carolina*, collected in Brown County, Ohio. Type and five paratypes in the writer's collection; one paratype in the collection of the Academy of Natural Sciences of Philadelphia.

The comparatively large pale brownish mine on the upper side of the leaf early attains its full extent; the loosened epidermis is then thrown into fine wrinkles, folding over the leaflet so as nearly to conceal the mine. The parenchyma is later almost entirely consumed. Mines collected June 27 and July 17 produced moths from the middle to the latter part of July; the date of emergence of the type is July 17. A second generation of larvae collected September 13 overwintered, pupating in the spring. One moth emerged April 26.

This species is characterized by the brilliant coloration—more brilliant than that of any other American species— and by the white outer half of the antennae.

Nepticula hypericella new species

Tuft on the head reddish orange, sometimes a few brown scales on the vertex; eye-caps silvery or pale golden, often shading to dark brown outwardly; antennal stalk dark fuscous; collar blackish, with a few brownish ocherous scales, especially on the dorsum. Fore wings bluish black, densely irrorate, each scale pale blue at the base, shading to black. Cilia gray, palest around the apex. Hind wings and cilia gray. Legs bluish black, tarsi paler, gray. Expanse: 4–5 mm.

Type and sixteen paratypes in the writer's collection; two paratypes in the collection of the Academy of Natural Sciences of Philadelphia. All were reared from larvae mining leaves of shrubby St. John's-wort (*Hypericum prolificum*) at Eastwood, Brown County, Ohio.

The linear upper side mine gradually increases to a breadth of two or three millimeters. At the time of pupation, a semicircular slit is cut in the lower epidermis, through which the larva may escape; very often, however, the cocoon is spun within the mine. In the latter case the bright brownish cocoon is placed with its anterior end at the slit in the epidermis. The mines were collected July 20; at this time many of the larvae had pupated. The imagoes emerged August 6 to 16; the date of emergence of the type is August 13.

This species is easily separated from the other dark unicolorous species by its orange tuft and dark collar; from *N. castaneaefoliella* and *N. flavipedella* furthermore by the speckled appearance of the wings.

NOTES ON WEST INDIAN DERMAPTERA, WITH THE DESCRIPTION OF A NEW SPECIES OF VOSTOX

BY JAMES A. G. REHN

The material here recorded has been secured in the last few years or submitted in connection with the study of series of West Indian Orthoptera. I wish to thank Mr. C. C. Gowdey, Government Entomologist of Jamaica and Señor José Cabrera, of Cotorro, Cuba, for the opportunity to study most of the material here reported. For extensive notes on West Indian Dermaptera the student is referred to a more exhaustive study by Rehn and Hebard.[1]

LABIDURIDAE

PSALINAE

Psalis americana (Beauvois)

1817. *Forficula americana* Beauvois, Ins. Recueil. Afr. Amér., p. 165, Orth. pl. 14, fig. 1. ["San Domingo."]

JAMAICA.—Hill Garden, lower St. Andrew Parish, elevation about 800 feet, February 11, March 3 and 22, 1922 and April 3, 1921, (C. C. Gowdey, nos. 100 and 843), 1 ♂, 1 ♀, 2 immature individuals, [Jam. Dept. of Agr.]. Cape Clear, St. Mary Parish, May 12, 1923, (C. C. Gowdey; no. 971), one immature individual, [Jam. Dept. of Agr.].

The two adults from Hill Garden have the tegmina marked with orange, but the maculation of each is mesad in position, does not reach the external or distal margins, and by their contiguous position the two give the impression of a single spot.

Euborellia annulipes (H. Lucas)

1847. *Forficelisa annulipes* Lucas, Bull. Soc. Entom. France, (2), v, p. xxxiv. [Jardin des Plantes, Paris (probably introduced).]

JAMAICA.—Cross Roads, St. Andrew Parish, May 5, 1921, (C. C. Gowdey, no. 495), one immature specimen, [Jam. Dept. of Agr.].

This species is probably less abundant in Jamaica than *E. caraibea* and *E. stâli*, possibly representing a relatively recent

[1] Studies in West Indian Earwigs (Dermaptera). Bull. Amer. Mus. Nat. Hist., xxxvii, pp. 635–651, (1917).

introduction of this now nearly cosmopolitan species. It has been recorded by Rehn and Hebard[2] from Cinchona, in the Blue Mountains of Jamaica, at an elevation of 4900 feet. As at Cinchona numerous exotic trees and shrubs have been introduced in experimental gardens, it is quite probable the presence of the species there may be so explained.

Euborellia ståli (Dohrn)

1864. *F[orcinella] stål*i Dohrn, Stettin Entom. Zeit., xxv, p. 286. [♀, Java.]
1907. *Anisolabis minuta* Caudell, Journ. New York Entom. Soc., xv, p. 168. [♂, ♀; Arroyo and Mayaguez, Porto Rico.]

Jamaica.—Bath, St. Thomas Parish, March 9, 1921, (C. C. Gowdey; no. 425), one male, [Jam. Dept. of Agr.].

This is the species recorded from several Jamaican localities by Rehn and Hebard as *E. minuta*,[3] which since has definitely been placed in the synonymy of *stål*i by Hebard.[4]

Labiidae

spongiphorinae

Vostox cabrerae new species

A most interesting member of the genus, more nearly related to *V. brunneipennis* (Serville), of the southeastern United States, Mexico, Central America and northern South America, than it is to the South American *V. punctipennis* of Stål, which was described from Rio de Janeiro, Brazil. From *brunneipennis*, in both sexes the new species differs in the more quadrate pronotum, which is distinctly narrower than the width of the head across the eyes; in the male sex *cabrerae* differs in the more excavate and concave median section of the distal margin of the anal segment, in the more compressed, more elongate and dorsad subtectate pygidium, which on its ventral surface bears a pair of prominent acute tubercles, one on each lateral margin, in the forceps being more approximate at their bases and in their lateral elevation showing no sigmoid tendency, and in the subgenital plate having its distal margin less concave mesad; in the female sex the forceps in *cabrerae* are more slender and attenuate, with the proximal lamellation of the internal face

[2] Bull. Amer. Mus. Nat. Hist., xxxvii, p. 640, (1917).
[3] Ibid., p. 639.
[4] Mem. Dept. Agr. of India, Entom. Series, vii, pp. 206, (1923).

shorter and lighter in character. The color pattern very greatly resembles that of pale limbed specimens of *brunneipennis*.

The more elongate, flaring pronotum of *V. punctipennis* makes comparison with it unnecessary.

Type.—♂; Camoa, Havana Province, Cuba. December 29, 1922. (José Cabrera.) [Academy of Natural Sciences of Philadelphia, Type no. 5423.]

Size medium; form and texture as usual in genus.

Head with median section of occiput appreciably but not sharply marked off from the more inflated postocular genae and lateral sections of occiput. Antennae fifteen jointed, with third joint but faintly shorter than first, slightly more than twice as long as second, fourth joint two-thirds as long as third, fifth slightly longer than fourth, thence distad the articles are elongate moniliform. Eyes moderately prominent when seen from dorsum. Caudo-lateral angles of head broadly rounded when seen from dorsum.

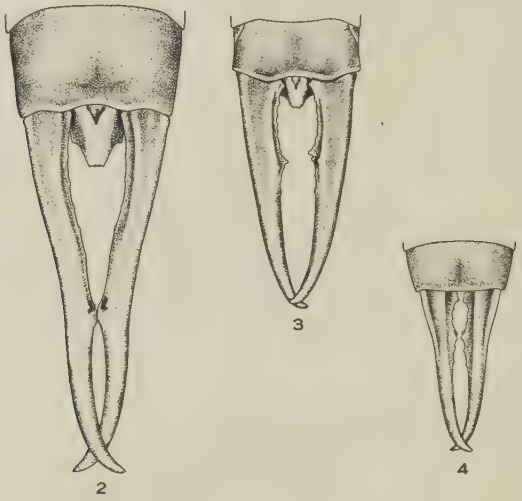
Fig. 1. *Vostox cabrerae* new species. Dorsal view of male (*type*). Camoa, Havana Province, Cuba. (× 3.)

Pronotum quadrate, length and breadth approximately equal, width not more than five-sixths that of head across eyes; lateral margins very faintly arcuate, subparallel, rounding to the distinctly arcuate, but not at all produced, caudal margin.

Tegmina nearly twice as long as greatest length of pronotum, with pronounced but well rounded latero-cephalic "shoulders"; lateral margins as seen from dorsum subparallel, non-carinate; greatest width of a single tegmen but faintly less than that of pronotum; distal margin of tegmen very weakly concavo-emarginate. Exposed portion of wings slightly longer than pronotum, apex straight truncate.

Abdomen subequal in width, with exposed tergites, except anal segment, distinctly shagreenous; third tergite laterad with a distinct, blunt, fold-like tubercle, second tergite with a much weaker fold in the same position. Anal segment transverse rectangulate in general form, greatest width nearly twice greatest length of same; lateral margins subparallel, distal margin shallowly concave mesad; surface of segment relatively smooth, weakly impressed meso-distad. Surface of all abdominal sternites weakly shagreenous; subgenital plate transverse, subrectangulate, greatest length contained about twice in greatest width, distal

margin broad, very weakly concave mesad, very broadly rounding laterad to the oblique, weakly arcuate lateral margins of plate.



Vostox cabrerae new species. Fig. 2. Anal segment, forceps and pygidium of male type. Fig. 3. Same view of male paratype. Fig. 4. Same view of female allotype (pygidium not evident in dorsal aspect). (× 8.)

Pygidium longer than basal width, completely filling area between forceps bases, proximal section of lateral margins, as seen from dorsum, straight, parallel, thence slightly oblique to three-fifths of length of pygidium, where these margins bear a nearly rectangulate tooth, median section of pygidium thence with obliquely converging lateral margins to the relatively broad, truncate apex, which bears small lateral tubercles and also several mesad on the ventral face of apex; dorsal surface of pygidium subtectate, lateral portions of this surface strongly declivent toward lateral margins; ventral surface of pygidium weakly subexcavate, slightly proximad of angles of lateral margins bearing on each side a pronounced, ventrad directed, relatively sharp tooth. Forceps elongate,[5] about three-fourths as long as remainder of body, slender, in lateral aspect faintly arcuate, not at all sigmoid; seen in dorsal aspect very weakly arcuate in proximal third, thence weakly sigmoid, converging to the

[5] See below for comments on these parts in the paratypic male.

apices, which are crossed; internal margin of forceps at a point between one-half and three-fifths of forceps length with a low blunt tooth, dorsal surface at middle with a distinct sharp, although relatively small, tooth; ventral surface of forceps deplanate, distal section of forceps appreciably flattened, proximal portion triquetrous in section.

Metatarsi of all limbs well supplied with hairs ventrad; caudal metatarsus subequal in length to second and third joints combined.

Allotype.— ♀; same data as type. [Academy of Natural Sciences of Philadelphia.]

Differing from the above description of the male in the following noteworthy features.

Head with dorsal surface of occiput less appreciably contrasted in contour, postocular genae and lateral sections of occiput less inflated. Eyes slightly less prominent.

Abdomen subfusiform, with exposed tergites, except anal segment, very weakly shagreenous; second and third tergites with tubercles and folds of male sex represented by mere rudiments. Anal segment transverse, subrectangulate, appreciably narrowing distad, greatest length contained nearly twice in proximal width of segment.

Pygidium small, carried vertically and closely encompassed by forceps bases, approximately hour-glass-shaped, being constricted mesad; distal extremity concavo-emarginate, developed laterad into distinct diverging acute angulations. Forceps of the type usual in the female sex of the genus, subparallel, moderately tapering, tips more arcuate, briefly crossed, deplanate on ventral surface, in section subtriquetrous proximad; lateral border of forceps as seen from above for greater portion of its length appreciably corded or cingulate; dorsal section in same area subcarinate, particularly proximad; internal surface of forceps dorsad with a very brief proximal lamellation, briefly proximad of proximal third are placed two pronounced tubercles, one dorsad and one ventrad, the former slightly more distad than the other, between the dorsal tooth and the proximal lamellation extends an evident subcrenulate carination, distad of paired tubercles the internal face bears a few low tubercles.

General color of pronotum, tegmina and head, except buccal region, palpi and antennae, pitch black; mouth-parts and antennae between raw sienna and buckthorn brown, proximal antennal joint nearer clear raw sienna. Exposed portion of wings light orange-yellow, broadly lined along internal margins and with distal section, to as much as a third, raw umber to

nearly pitch black. Abdomen ranging from pitch black with medio-longitudinal section both dorsad and ventrad paling to chestnut (allotype), through burnt sienna, darkened laterad with pitch black (paratypic female) to bay with anal segment solidly between chestnut and burnt sienna in tone, the venter paling to the same meso-longitudinally and on subgenital plate (type). Forceps of abdominal color in female, in males, with pygidium, dull auburn. Limbs light orange yellow. Sterna largely mummy brown of varying tonal depth on an ochraceous ground.

In addition to the type and allotype we have before us a paratypic male bearing the same data as the type. This specimen is interesting as representing the brachylabic condition of the species, while the type represents the macrolabic phase. In consequence the following notes on the brachylabic form are of value, as in general appearance the forceps of the two are superficially very different.

Pygidium proportionately shorter and broader than in the type, length and breadth more nearly subequal; medio-distal section much less produced, subarcuate, thus making the lateral rectangulations occur at four-fifths of the pygidial length; tubercles distad and on venter as in type. Forceps two-thirds as long as in type, much simpler, as seen from dorsum tapering with tips rather briefly hooked as in female, no sigmoid tendency indicated; at proximal third ventro-internal margin bears a low tuberculous projection with several teeth; dorso-internal section slightly distad of this point with a single tooth or a group of two small teeth; in other respects the forceps are essentially as in type.

Measurements (in millimeters)

	Length of body (excl. of forceps)	Length of pronotum	Length of tegmen	Length of pygidium	Length of forceps
♂, *type*	10	1.4	2.6	.9	6
♂, *paratype*	8	1.2	2.3	.6	3.7
♀, *allotype*	9.2	1.2	2.3	—[6]	2.5

We take pleasure in dedicating this most interesting species to its collector, Señor José Cabrera, of Cotorro, Cuba, who has kindly placed in our hands for study most interesting collections of Cuban Orthoptera.

[6] Due to the vertical position of the pygidium of the female an accurate measurement is not possible.

It is quite possible this is the insect reported from Cuba by Bolivar as *Spongophora brunneipennis*,[7] on the basis of material secured by Gundlach. Superficially the two could readily be confused, but more careful comparison will demonstrate their distinctness.

LABIINAE

Labia curvicauda (Motschulsky)

1863. *Forficelisa curvicauda* Motschulsky, Bull. Soc. Nat. Moscou, XXXVI, pt. II, p. 2, pl. II, fig. 1. [Nura-Ellia Mountains, Ceylon.]

JAMAICA.—Belfield, St. Mary Parish, May 9, 1922, (C. C. Gowdey; no. 893), one male, [Jam. Dept. of Agr.]. Whitehall, St. Mary Parish, June 7, 1922, (C. C. Gowdey; no. 893), one female, [A. N. S. P.].

Prolabia jamaicana Rehn and Hebard

1917. *Prolabia jamaicana* Rehn and Hebard, Bull. Amer. Mus. Nat. Hist., XXXVII, p. 645, pl. LXII, figs. 3 and 4, LXIII, fig. 3. [♂, ♀; Cinchona, Mandeville (type locality) and Montego Bay, Jamaica.]

JAMAICA.—Pleasant Hill, Blue Mountains, elevation 3700–3800 feet, July 21 and 28, 1923, (Rehn: on ground under dead banana sprout and under dead banana blossom), two females, [A. N. S. P.].

Prolabia pulchella (Serville)

1839. *Forficula pulchella* Serville, Hist. Nat. Ins., Orth., p. 42. [♂, ♀; "North America, Niagara."]

CUBA.—Camoa, Havana Province, December 29, 1922, (José Cabrera), one male, one female, [A. N. S. P.].

These specimens are fully typical of *pulchella*, which previously was known only from the southeastern United States. The form of the male pygidium is identical with that of material from Georgia and Florida, and as figured by Rehn and Hebard.[8] Both specimens have the wings non-evident.

Possibly the characteristic Greater Antillean species of this type, *P. unidentata* (Beauvois)[9], is limited in Cuba to the eastern

[7] Mém. Soc. Zool. France, I, p. 120, (1888).
[8] Bull. Amer. Mus. Nat. Hist., XXXVII, pl. LXII, fig. 8, (1917).
[9] Ibid., p. 647.

portion of the island, from which section alone came the Cuban material examined by us previously. Another suggestion is that *pulchella* has been introduced in western Cuba from the adjacent United States. Regardless of any explanation of its presence at Camoa, the material from there now before us represents *pulchella*.

THE LIFE HISTORY OF DANAUS BERENICE STRIGOSA BATES (LEPIDOPTERA; DANAIDAE)

BY KARL R. COOLIDGE

Los Angeles, California

The form *strigosa* Bates, among other characters distinguished from the typical *berenice* Cramer by the ashen gray vein bordering of the secondaries above, is the characteristic butterfly of the deserts of California. It also occurs spasmodically along the sea-coast, at least as far north as Santa Barbara.

In the more arid regions, however, and especially on the Colorado Desert, it is a common affair. At Palm Springs it can be seen on the wing practically every day of the year and is far more abundant than its congener *archippus*. Hibernation occurs during the cooler winter months, with any sunny day bringing it out for a sojourn. In the intense heat of midsummer the butterflies are on the wing at dawn and fly on almost to darkness, taking their siesta, as do the other desert folk, in the hotter hours of the day.

In June, 1919, I searched many plants of *Asclepias eriocarpa* Bentham at Palm Springs for eggs or larvae of *strigosa*, but in vain. However, a few days later I noted a female hovering ovipositingly over a small clump of mesquite and then watched her deposit an egg on a scrawny vine that scrambled over the small tree. This proved to be the climbing milkweed, *Philabertia linearis*, and I have since observed many other instances of the egg laying, which is no simple feat, the females having to perform considerable acrobatic stunts to place their eggs on the food-plant, due to the slenderness of the stems—hardly thicker than a match.

Returning to Los Angeles with a few larvae, and my supply of *Philabertia* giving out, I offered them fresh leaves of our local *Asclepias mexicana* Cav., and these they attacked avidly and without a second's hesitation. But on the desert *Philabertia* is their chosen food, and I have yet to find a larva on any desert *Asclepias*. *Nerium* has also been listed as a food-plant for *strigosa* and Grossbeck, Insects of Florida, gives *Vincetoxicum palustre* as a food for *berenice*, on the authority of Dr. Dyar.

There are at least six broods of *strigosa* on the Colorado Desert. From almost the first of January, and all during that month, fresh examples are emerging. Towards the latter part of March comes another flight, and the middle of June finds a third. On August first fresh specimens again appear, still more the middle of September, with a final brood late in October.

After escaping from the egg, some larvae will devour the shell to the base, while others scarcely nibble at it. All parts of the *Philabertia* are eaten, including the flowers, which are very attractive to the adults. The larvae bring havoc to their food-plant, eating through the narrow stems, and frequent dried and dead masses of *Philabertia* indicate disconnection from the main vine by the visitations of *strigosa* caterpillars. A time record of the transitions follows:

Eggs laid June 13.	Passed fourth molt June 30.
Hatched June 18.	Suspended July 8.
Passed first molt June 22.	Pupa disclosed July 9.
Passed second molt June 24.	Disclosed adult July 19.
Passed third molt June 27.	

The Egg.—In shape stout truncato-fusiform. Swelling out evenly from base to the greatest breadth, in the middle of the lower two-thirds, and thence narrowing roundly to the truncate summit.

Marked longitudinally by a series of twenty-five straight, broad, stout ribs, arising at the base and with nearly all terminating abruptly about the micropyle; a few coalesce with adjoining ribs at a distance of .28 mm. from the micropylar area. These ribs are .1 mm. apart and .04 mm. in thickness. Between them the surface is concave, minutely punctate and glistening, and transverse ribs, .02 mm. in thickness and .035 mm. equidistant, show prominently. These transverse ribs are straight, proceeding on to the summits of the longitudinals and giving to them a beaded appearance. The micropyle but slightly depressed, .15 mm. in diameter.

Color, to the naked eye, creamy white. Under magnification greenish white, the ground color of the egg being a very pale green, with the longitudinal and transverse ribs opaque.

Height, 1.20 mm.; breadth at base, .80 mm.; at apex, .12 mm.; greatest breadth, .96 mm.

First Instar.—Head shining black, .52 mm. in diameter, with a fringe of black bristles, .08 mm. in length, mounted on black papillae.

Body cylindrical, the segments even, the surface of body minutely granulated. Studded with six rows of black papillae, from which arise sharp black hairs. A ventrostigmatal series, .02 mm. in height, situated on circular brownish patches, and in line with the spiracles; the sharp hairs from these .16 mm. in length. A substigmatal series, situated posteriorly on the segments, and forming with the spiracles and ventrostigmatal row a right triangle; the hairs of this row .10 mm. in length. The papillae of the ventrostigmatal and substigmatal series absent on the thoracic segments. A laterostigmatal series, in line with the spiracles, the projecting hairs, .14 mm. in length. A subdorsal row of similar papillae, on the posterior edges of segments, the bristles from these projecting posteriorly and .10 mm. in length. Two mediodorsal rows, .14 mm. apart on the middle segments and located posteriorly; the bristles of these erect, .16 mm. in length. The brownish fuscous laterodorsals of the first thoracic subtriangular and but slightly elevated; the mediodorsal series of hairs arise from it centrally, and the laterostigmatal series from either lateral corner.

On the second thoracic, and second and eighth abdominal segments, reddish brown, blunt, ovate tubercles, in pairs, .10 mm. in height, .16 mm. in diameter at base, .12 mm. at the summit, and beset with many minute thick black bristles.

Color of body pale green, becoming paler and paler as the stage proceeds, until towards the close of the instar the ground coloration is a yellowish brown. On each segment, except the first and last, there develops a reddish brown transverse band, .16 mm. in width. Situated on these, subdorsally, two to a segment, are conspicuous lemon-yellow elongated bars, .18 mm. in length. The segmental creases also become finely banded with reddish brown. The first segment pallid, and lacking the lemon-yellow spots, while the ninth and tenth have the transverse reddish band only weakly developed, the citron bars absent, and on the tenth there is a brownish black irregular patch. Spiracles, .02 mm. in diameter, circular, surrounded by a brownish ring.

Length, 2.24 mm.; width at first thoracic, .50 mm.

Second Instar.—Head shining black, with center of triangle white; two transverse white bands parallel to hind margin, narrow, narrowing and interrupted by the median suture. The hairs of head black, sharp, averaging .10 mm. in length. Diameter of head .86 mm.

Body hairs fine, black, averaging .10 mm. in length. Filaments of second thoracic .82 mm. in height, .28 mm. in diameter at base, and .06 mm. at tip. Filaments of second abdominal .40 mm. in height, .20 mm. in diameter at base and .08 mm. at tip. Filaments of eighth abdominal .50 mm. in height, .26 mm. in diameter at base and .08 mm. at tip. These filaments dark reddish brown, with needles frequent, sharp, black, averaging .12 mm. in length. Spiracles .04 mm. in diameter, black, with a surrounding paler annulation.

Ground color of body reddish violet. Irregular narrow stripes of bluish white serve to bring out strongly the bands of ground color in which the citron spots are contained, there being three such stripes between each band. On the sides these bluish white stripes fade into citron. The citron bars now .44 mm. in length. On the eighth abdominal these are reduced, but .14 mm. in length. On the ninth they are replaced by a smear of citron not definitely shaped. They are entirely absent on the first thoracic and tenth abdominal, and on the latter there is a brownish chitinous patch. The first thoracic is almost wholly white, lacking the dark transverse band. The two chitinous patches of first thoracic, piceous, .26 mm. in length, irregular. Surface of body very coarsely granulated. Prolegs and legs reddish brown, tipped with darker.

Length, 7.5 mm. Width at first thoracic, 1.14 mm.; at anal segment, .68 mm.

Third Instar.—Head black, with the center on the triangle white; two even transverse bands, .14 mm. in width, parallel to hind border and broken in the middle by the suture. Hairs of head black, sharp, averaging .12 mm. in length, arising from black tubercles .02 mm. in height and width. Diameter of head, 1.24 mm.

Color now a deep reddish violet. The citron dorsal spots as before and at start of moult .54 mm. in length. The citron spots of eighth abdominal reduced, only .22 mm. in length. On

ninth abdominal they completely disappear, but are replaced by a pale blotching of light yellow. Last segment almost wholly white, with a black bar. Blister of first thoracic .32 mm. in length, black. Also on first thoracic an irregular whitish transverse band, sometimes tinged with yellow. Each segment has four fine transverse bluish bands, about .04 mm. in width, but varying and especially prominent on the thoracic segments; these run in pairs, two on either border, and they terminate substigmatally in irregular V-shaped citron marks, each line of each pair leading to a point of the V. The body hairs rather frequent, .14 mm. in length, black, finely pointed. Spiracles, .05 mm. in diameter, annulated with black. Ventral surface reddish brown; legs and prolegs concolorous, black tipped.

Filaments of second thoracic subcylindrical, ending quite roundly, and 1.26 mm. in height; they are .30 mm. in diameter at base and .06 mm. at apex; dark reddish brown and studded with short black hairs, appressed and projecting laterally anteriorly. Filaments of second abdominal .80 mm. in height, .18 mm. in diameter at base and .06 mm. at summit; erect and colored and clothed as in the other filaments. Filaments of eighth abdominal .84 mm. in height, .34 mm. in diameter at base, with the hairs of these, as well as the other filaments, .24 mm. in length; these posterior filaments projecting posteriorly, but appressed as in the anteriors.

Length, 9.5 mm. Width at first thoracic, 1.40 mm.; height at first thoracic, 1.60 mm. Width at anal segment, .80 mm.

Fourth Instar.—Head black, with center of triangle white, and there is also a half crescent white bar on extreme lower frontal face. The two transverse white bands as before, conspicuous, .30 mm. in width. Hairs of head rather frequent, black, sharp, .26 mm. in length. Diameter of head, 1.90 mm.

Ground color deep violet. The bluish bands as in previous stage, more prominent, as are the citron V's in which they terminate. The transverse bands containing the citron spots deep velvety black. The first thoracic segment white, with a transverse black band, but lacking the citron dorsal spots. Ninth abdominal with a conspicuous citron smearing, but not definitely shaped into spots. The tenth abdominal white,

entirely lacking any citron coloration, and with an irregular triangular black patch.

All filaments black. Those of the second thoracic 5 mm. in length, .40 mm. in diameter at base and .08 mm. at tip, projecting anteriorly and now much appressed. Filaments of second abdominal segment, 2.5 mm. in height, .38 mm. in diameter at base and .04 mm. at apex. Filaments of eighth abdominal, 2 mm. in height, .38 mm. in diameter at base and .04 mm. at peak. Needles of filaments very dark reddish brown, sharp, .1 mm. in length. The numerous coarse serrations black, .02 mm. in height, inclined apically. Body hairs black, frequent, sharp, .14 mm. in length. Spiracles oval, black, .20 mm. in length. Ventral surface, legs and prolegs very dark reddish brown.

Length, 13 mm. Width at first thoracic, 2 mm.; width at anal segment, 1.80 mm.

Fifth Instar.—Head black, with center of triangle white; crescent on lower frontal face and the two white conspicuous transverse bands as before. Hairs of head numerous, sharp, black, .30 mm. in length. Diameter of head, 3.20 mm.

Ground color of body deep velvety black. In addition to the citron bars on posterior edges of segments, small bluish bars mediodorsally on anterior edge, but absent on thoracic and ninth and tenth abdominal. The bluish stripes conspicuous, terminating as before in substigmatal citron V's, but anteriorly the V's have only one connecting blue band, the second prong ending blindly. The citron bars now 2 mm. in length. On eighth abdominal they are reduced to a mere point; on the ninth lacking, being replaced with a smear of citron as before; on tenth entirely lacking and on this segment dorsally a cordate black patch. First thoracic white, also lacking in citron except occasionally a vestige of the citron substigmatal V. A prominent narrow even black bar on first thoracic. One larva lacked the citron spots on the thoracic and first abdominal segment, and on the ninth abdominal an even conspicuous citron bar was present.

All filaments deep velvety black. Filaments of second thoracic, 7.1 mm. in length, .60 mm. at base, .10 mm. at tip. Filaments of second abdominal, 4.5 mm. in length, .50 mm. in diameter at base, .25 mm. at tip. Filaments of eighth abdominal, 3.9 mm. in length, .50 mm. in width at base and .25 mm.

at tip. Needles of filaments black, sharp, straight, .19 mm. in length. The coarse serrations black, strong, .035 mm. in height, inclined apically. Body hairs as before, black, sharp, averaging .35 mm. in length. Spiracles oval, black, .32 mm. in length. Prolegs, legs and ventral surface solidly sooty black.

Length, at start of instar, 27 mm.; at maturity, 40 mm. Width at first thoracic, 2.9 mm.; at anal segment, 2.80 mm.

The Pupa.— Color pale creamish white, with only the slightest, almost imperceptible greenish tinge. The wing cases solidly cream colored. The transverse band on the third abdominal segment as in *archippus*, anteriorly shining black, posteriorly gilt. The abdominal segments above have this obscure dirty grayish. The ocellar tubercles gold. The cremaster shining piceous and from it dorsally extend two concolorous streaks to a distance of 2 mm., forming a hair-pin mark. Basal wing tubercles conspicuously gold. On mesothorax a prominent pair of gold tubercles, 1.75 mm. apart. Anterior to these two much less conspicuous, unelevated golden dashes, 3.5 mm. apart. The dorsal wing case tubercles scarcely elevated, elongated, golden. Spiracles of body coloration.

Length, 20 mm. Breadth of body at abdomen, 7 mm. Height of abdomen, 8 mm. Height of thorax, 6.40 mm. Breadth at hind border of mesothorax, 5 mm.; at basal wing tubercle, 6.20 mm.; at ocellar tubercles, 3 mm. Ocellar tubercles, .50 mm. in height. Length of cremaster, 1.90 mm.; width of cremaster, .55 mm.

RECORDS OF EUROPEAN ACRIDIDAE, TETTIGONIIDAE AND GRYLLIDAE (ORTHOPTERA)

BY MORGAN HEBARD

During the summers of 1906 and 1908 the author was able to accomplish a limited amount of Orthoptera field work in the western portions of central Europe. The journeys, though having the advantage of being largely by motor, were not primarily for the purpose of collecting. The shortness of available time prevented a representative collection being assembled, but a sufficient series of grasshoppers, katydids and crickets was secured, we believe, to warrant publication of the records and notes. The absence from this collection of most of the scarcer forms was due partly to inexperience, at that time, on the part of the collector, but opportunity did not arise to examine most of the localities other than hastily, and the rich regions of Spain, southern France and northern Italy were not visited.

In summarizing we would observe that very little could be found in England, Holland and northeastern France. Near Berlin, in the Vosges and in the Alps much better results were obtained, but Orthoptera was not encountered in large numbers and great diversity except in the vicinity of Geneva, Switzerland, and in adjacent France. Work about Rome was productive, though we did not find as much in midsummer as had been expected.

A vastly greater number of the more interesting species could have been secured in the same amount of time along the Mediterranean, and particularly in the mountains and semi-arid valleys of Spain.

We have found the most important literature in studying this material to be the following publications:

1882. Brunner. Prodromus der Europäischen Orthopteren.

1898. Bolivar. Catalogo Sinoptico de los Ortopteros de la Fauna Iberica.

1910. Burr. A Synopsis of the Orthoptera of Western Europe.

1917. Zacher. Die Geradflügler Deutschlands und ihre Verbreitung.

1922. Chopard. Faune de France. Orthoptères et Dermaptères.

We have omitted the Dermaptera, Blattidae, Mantidae and Phasmidae, as an insufficient number of species was secured to justify publication of the records.

In the present paper nineteen hundred and seventy-one specimens have been recorded, representing forty genera and sixty-four species. A large and representative series of European Orthoptera at the Academy of Natural Sciences of Philadelphia, received as a gift from Dr. H. de Saussure, and in exchange with the British Museum, Geneva Museum and H. Karny, has been of great value in studying the present material.

ACRIDIDAE

Acrydiinae

Paratettix meridionalis (Rambur)

Italy: Villa Senni, near Rome, July 25, 1908, (active, on moist ground), 5 ♂, 3 ♀. Santa Agnese, Rome, July 24, 1908, (from grass in boggy area), 2 ♂, 5 ♀.

Acrydium ceperoi (Bolivar)

Italy: Villa Senni, near Rome, July 25, 1908, (very scarce on dry hillside with short yellow grass), 2 juv. ♀.

We also have seven specimens taken at Castelvetro and Spilamberto, in Emilia, by C. Menozzi. The vertex in the present series agrees closely with Chopard's figure.[1] The pronotum has its medio-longitudinal carina quite as prominent as in *A. bipunctatum* (Linnaeus), though the general appearance is not as tectate. The margins of the cephalic femora are very feebly undulate, a similar undulation slightly stronger on the median femora.

Acrydium subulatum (Linnaeus)

Italy: Santa Agnese, Rome, July 24, 1908, (in wet grassy area), 2 ♂, 1 juv. ♀.

[1] Faune de France, 3, Orth. et Dermapt., p. 120, fig. 328, (1922).

Acrydium bipunctatum bipunctatum (Linnaeus)

FRANCE: La Guerche, Cher, August 17, 1906, (from ditches along road in heavy deciduous forest), 2 ♂, 1 ♀, 3 juv.

From a considerable series before us it appears more than probable that the insect generally recognized as *kraussi* is simply the adaptation of the present species to a colder environment. We believe the name should be given geographic racial, but not higher, significance.

It is also probable that *T. kiefferi* Azam and the synonym *T. gavoyi* Azam are based on material showing the intergradation between these races, and should therefore be placed in synonymy.

We have before us typical *bipunctatum* from the following localities, represented by a series of fifty-three specimens: Eastern Siberia; Kaluga, Russia; Kawiercie, Poland; Porta, Westphalia and Meerane, Saxony, Germany; Himmel, Rosenburg, Höllenheim, Sievering, Steiermark, Teichalpe, Graz and Fürstenfeld, Austria; Roumania; Boccagnazo, Dalmatia.

Acrydium bipunctatum kraussi (Saulcy)

GERMANY: Berlin, August 28, 1906, 1 ♀.

SWITZERLAND: Schwellenhöhe, Bernese Oberland, 5000 to 6000 feet, August 12, 1906, (well below timber line in open, on tufts of alpine herbage and moss), 4 ♂, 6 ♀, 3 juv. St. Niklaus, Valais, 3708 feet, August 19, 1908, 1 ♀. Zermatt, Valais, August 18, 1908, 1 ♀.

In addition to the material recorded above, a series of nine other specimens, from the following localities, are before us: Kawiercie, Poland; N. Bogsan and Podspady-Höhlen, Hungary; Raunstein, Eichkogl and Styrian Alps, Austria; Monte Vallestra, Emilia, Italy.

The presence of this insect and typical *bipunctatum* at the same locality probably indicates great environmental differences in the surrounding country.

Acrydium depressum (Birsout)

SWITZERLAND: St. Niklaus, Valais, 3708 feet, August 19, 1908, 1 ♂, caudate pronotum.

ITALY: Villa Senni, near Rome, July 25, 1908, (very scarce on dry hillside with short yellow grass), 2 ♂, abbreviate pronotum.

Acridinae

Acrida turrita Linnaeus

Italy: Tomb of Maximus, near Rome, July 24, 1908, (in weedy field among clumps of higher weeds, thistles and raspberry vines), 2 juv. ♂, 3 juv. ♀.

Paracinema tricolor (Thunberg)

Italy: Villa Senni, near Rome, July 25, 1908, (among low reeds and water weeds, many more very immature present), 10 ♂, 8 ♀.

We also have two males and a female before us from the Department of Indre, France.

Mecostethus alliaceus (Germar)

France: Douvaine, Haute Savoie, August 14, 1906, (in field of dry grass), 9 ♂, 3 ♀. Evires, Haute Savoie, August 15, 1906, (in dry grassy field), 6 ♂, 4 ♀.

Switzerland: Hermance, Geneva, August 14, 1906, (among swarms of Orthoptera in dry grassy field), 23 ♂, 15 ♀. Frankendorf, Basle, August 9, 1906, (quite numerous and very active, both flying and jumping, in a ditch filled with dry grass), 3 ♂, 1 ♀.

Chrysochraon brachypterus (Ocskay)

Switzerland: Mount Pilatus, Unterwalden, 4950 feet, August 10, 1906, (in tall grass near timber line), 3 ♂, 6 ♀. Near Wiesen, Soleure, August 9, 1906, (in pass west of Olten, grassy spot), 1 ♀.

The fastigium is unusually blunt in the series from Mount Pilatus.

Stenobothrus stigmaticus (Rambur)

France: St. Cécile, Ain, August 21, 1908, 3 ♀.

Stenobothrus lineatus (Panzer)

England: Brighton, Sussex, July 28, 1906, (in short herbage on open flat country above chalk cliffs), 1 ♀.

Germany: Berlin, August 28, 1906, 3 ♂, 3 ♀.

France: Chaumont, Haute Marne, August 7, 1906, (on barren hillside near pine forest), 2 ♂, 1 ♀. Montigny, Meuthe et Moselle, August 8, 1906, (in small meadow of tall grass), 5 ♂,

5 ♀. St. Dié, Vosges, August 8, 1906, 2 ♀. Muides, Loire et Cher, August 20, 1906, 1 ♂. Douvaine, Haute Savoie, August 14, 1906, (in dry grassy field), 10 ♂, 8 ♀. Evires, Haute Savoie, August 15, 1906, (in dry grassy field), 3 ♂.

SWITZERLAND: Hermance, Geneva, August 14, 1906, (in dry grassy field), 9 ♂, 8 ♀. Zermatt, Valais, August 18, 1908, 5 ♂, 2 ♀. St. Niklaus, Valais, 3708 feet, August 19, 1908, 1 ♂. Brunig Pass, Unterwalden, Bern, 3200 feet, August 11, 1906, (along edge of grassy field), 1 ♂, 1 ♀. Near Wiesen, Soleure, August 9, 1906, (in plants growing among rocks), 1 ♂, 1 ♀.

Omocestus haemorrhoidalis (Charpentier)

FRANCE: Lusigny, Aube, August 7, 1906, (in grass), 1 ♂. St. Cécile, Ain, August 21, 1908, 2 ♂, 3 ♀.

SWITZERLAND: Hermance, Geneva, August 14, 1906, (in dry grassy field swarming with Orthoptera), 1 ♂, 1 ♀. St. Niklaus, Valais, 3708 feet, August 19, 1908, 7 ♂, 11 ♀.

Omocestus petraeus (Brisout)

ITALY: Tomb of Maximus, near Rome, July 24, 1908, (in dry weedy field), 1 ♂, 1 ♀. Villa Senni, near Rome, July 25, 1908, (very active, on dry hillside of short yellow grass), 14 ♂, 9 ♀.

Omocestus ventralis (Zetterstedt)

FRANCE: Muides, Loire et Cher, August 20, 1906, 2 ♂, 1 ♀. La Guerche, Cher, August 17, 1906, (in ditches along road in deep forest), 5 ♂, 1 ♀. Champagne, Ain, August 16, 1906, (dry grass at foot of rocks among oaks), 3 ♂, 1 ♀. Douvaine, Haute Savoie, August 14, 1906, (in dry grassy field swarming with grasshoppers), 3 ♂, 4 ♀.

SWITZERLAND: Hermance, Geneva, August 14, 1906, (in dry grassy field), 6 ♂, 1 ♀.

ITALY: Santa Agnese, Rome, July 24, 1908, (in wet grassy area), 1 ♂.

Omocestus viridulus (Linnaeus)

GERMANY: Hamburg, August 29, 1906, 1 ♂, 1 ♀.

FRANCE: Gerardmer, Vosges, August 8, 1906, (in grassy opening of heavy spruce forest), 2 ♂, 5 ♀, 1 juv. Col de la Schlucht, Vosges Mountains, Vosges, August 9, 1906, (on huckleberry bushes in opening of spruce forest), 3 ♂, 3 ♀, 1 juv. Above Sulzeren, Vosges Mountains, Alsace, August 9, 1906. 1 ♂.

SWITZERLAND: Zermatt, Valais, August 18, 1908, (in alpine herbage), 1 ♂, 4 ♀. Münster, Valais, August 18, 1908, (in lush herbage), 2 ♂, 4 ♀. Grimsel Hospice, Bernese Oberland, 6155 feet, August 17, 1908, (in alpine herbage among great rocks), 1 ♂, 1 ♀. Schwellenhöhe, Bernese Oberland, 5000 to 6000 feet, August 12, 1906, (generally distributed in alpine herbage, especially above timber line), 4 ♂, 9 ♀. Mount Pilatus, Unterwalden, Bern, 4950 feet, August 10, 1906, (in alpine herbage), 2 ♂, 3 ♀. Kaiserstuhl above Giswil, Unterwalden, August 11, 1906, (plentiful in high grass), 1 ♀. Brunig Pass, Unterwalden, August 11, 1906, (along edge of grassy alpine field), 1 ♀.

Stauroderus vagans (Eversmann)

FRANCE: Thorens, near Annecy, Haute Savoie, August 15, 1906, (in a waste field), 1 ♀.

SWITZERLAND: Grengiols, Rhone Valley, Valais, August 18, 1908, 1 ♂, 3 ♀.

Stauroderus biguttulus (Linnaeus)

After examination of the very large series before us, we find ourselves unable to distinguish specifically the condition to which the name *S. bicolor* (Charpentier) has been applied. That name was reduced to varietal rank by Zacher in 1917.[2] Both types frequently occur at the same locality and it is evident that geographic races are not represented. In the male sex the contrast between these types is very striking, but we believe that individual variation may wholly account for such differentiation in a species which clearly shows very decided plasticity. Chopard's figures of the tegmina are inaccurate, though his study is easily the most valuable as an aid in distinguishing the European species of this difficult group.[3]

ENGLAND: Exeter, Devonshire, July 14, 1906, (in grass on hills), 1 ♂.

GERMANY. Berlin, Brandenburg, August 28, 1906, 5 ♂, 5 ♀. Triberg, Baden, August 10, 1908, (moderately common everywhere in grassy openings of Black Forest), 1 ♂.[4]

[2] Die Geradflügler Deutschlands, p. 136.

[3] Faune de France, 3, Orth. et Dermapt., p. 128, (1922).

[4] In notes, "An active, strong and quick-flying species, continually stridulating. The note was a 'sikkkkk,' not as sharp as that of the North American *Chloealtis conspersa* Harris, but more whirring."

FRANCE: Lusigny, Aube, August 7, 1906, (in grass), 2 ♂, 3 ♀. Estissac sur Vanne, Aube, August 7, 1906, 3 ♂, 3 ♀. Pont-sur-Yonne, Yonne, August 6, 1906, (in short grass), 6 ♂, 1 ♀. Chaumont, Haute Marne, August 7, 1906, (on barren hillside near pine forest), 1 ♀. Montigny, Meuthe et Moselle, August 8, 1906, (in small meadow of tall grass), 1 ♂, 1 ♀. St. Dié, Vosges, August 8, 1906, (on grassy hillside), 1 ♂. Cléry, Loiret, August 20, 1906, 8 ♂, 2 ♀. Muides, Loire et Cher, August 20, 1906, 6 ♂, 3 ♀. Blois, Loire et Cher, August 20, 1906, 8 ♂, 7 ♀. Tours, Indre et Loire, August 18, 1906, (among rich grasses on river bank), 8 ♂, 8 ♀. Chaumont sur Loire, August 20, 1906, 2 ♂. La Guerche, Cher, August 17, 1906, (in grasses along road in heavy forest), 8 ♂, 6 ♀. St. Hilaire, Nièvre, August 17, 1906, (beside road in short grass), 4 ♂, 3 ♀. Bourg, Ain, August 16, 1906, (in field), 3 ♂, 3 ♀. Fort de l'Ecluse, Ain. August 20, 1908, (from grasses on roadside), 1 ♂, 1 ♀. St. Cécile, Ain, August 21, 1908, (on barren heather-covered hilltop), 1 ♂, 3 ♀. Champagne, Ain, August 16, 1906, (in dry grass at foot of rocks), 2 ♂, 2 ♀. Douvaine, Haute Savoie, August 14, 1906, (in field of dry grass), 5 ♂, 4 ♀. Evires, Haute Savoie, August 15; 1906, (in dry grassy field), 8 ♂, 2 ♀. Thorens near Annecy, Haute Savoie, August 15, 1906, (in waste field), 1 ♀.

SWITZERLAND: Hermance, Geneva, August 14, 1906, (great numbers in dry grassy field), 26 ♂, 19 ♀. Zermatt, Valais, August 18, 1908, 4 ♂, 6 ♀. St. Niklaus, Valais, 3708 feet, August 19, 1508, 5 ♂, 14 ♀. Geschenen, Uri, July 22, 1908, (in alpine herbage), 1 ♂, 1 ♀. Thun, Bern, August 13, 1906, 3 ♂, 1 ♀. Schlierenthal, Unterwalden, August 11, 1906, (in grass about bushes near stream), 2 ♀. Giswil, Unterwalden, August 11, 1906, (common in high grass), 1 ♀. Near Wiesen, Soleure, August 9, 1906, (in plants among great rocks), 4 ♂, 3 ♀. Frankendorf, Basle, August 9, 1906, (open grassy field), 1 ♂, 8 ♀.

ITALY: Milan, July 23, 1908, (in weeds in city), 1 ♂, 3 ♀. Tomb of Maximus, near Rome, July 24, 1908, (in dry weedy field), 2 ♂. Villa Senni, near Rome, July 25, 1908, (from blackberry tangle), 1 ♀.

Stauroderus scalaris (Fischer)

SWITZERLAND: Münster, Rhone Valley, Valais, August 18, 1908, (in lush herbage), 1 ♀. St. Niklaus, Valais, August 19, 1908, 5 ♂, 12 ♀. Zermatt, Valais, August 18, 1908, (in lush alpine herbage), 8 ♂, 18 ♀, 1 juv. ♀.

There are also males from Luchon, and Tarascon, Ariège, France, in the author's collection.

Chorthippus parallelus (Zetterstedt)

We can find no justification for separating any of the material before us as *C. longicornis* (Latreille). Zacher questions the validity of that species, and the large amount of material now at hand would indicate that the name is based on nothing more than a local development of *parallelus*, probably not worthy of even racial recognition.

To this species exceedingly close relationship is shown by the described North American forms of *Chorthippus*.

ENGLAND: Brighton, Sussex, July 28, 1906, (moderately common in short green grass of open flat country above coast cliffs), 15 ♂, 13 ♀, 1 juv., (extremely depauperate). Stratford-on-Avon, Warwick, July 18, 1906, (in high grass), 1 ♂, 1 ♀. Exeter, Devon, July 14, 1906, (short grass in hillside pasture), 9 ♂, 2 ♀.

GERMANY: Hamburg, August 29, 1906, 2 ♀.

BELGIUM: Antwerp, July 15, 1908, (in short grass), 6 ♂, 5 ♀.

FRANCE: Boulogne, Pas-de-Calais, July 31, 1906, (only grasshopper seen in a grassy meadow), 1 ♀. Samer, Pas-de-Calais, July 31, 1906, (moderate numbers in a grassy corner), 2 ♂, 4 ♀. Doulliens, Pas-de-Calais, July 31, 1906, 1 ♂, 2 ♀. Beauvais, Oise, August 1, 1906, 2 ♂, 6 ♀. Pont-sur-Yonne, Yonne, August 6, 1906, (in grass on roadside), 6 ♀. Froissy, Aube, August 7, 1906, (in marsh), 2 ♂, 3 ♀.[5] Lusigny, Aube, August 7, 1906, 1 ♂. Montigny, Meuthe et Moselle, August 8, 1906, (in small meadow of high grass), 4 ♂, 2 ♀. St. Dié, Vosges, August 8, 1906, (on grassy hillside), 3 ♂, 1 ♀. Gerardmer, Vosges, August 8, 1906, (in grassy opening in heavy spruce forest), 1 ♀. Above Sulzeren, Vosges Mountains, Alsace,

[5] The stridulation of this grasshopper is much like that of the North American *Chorthippus curtipennis* (Harris).

August 9, 1906, (open field in spruce forest), 1 ♂, 1 ♀. Cléry, Loiret, August 20, 1906, 2 ♂. Tours, Indre-et-Loire, August 18, 1906, (in lush grass on river banks), 3 ♂. La Guerche, Cher, August 17, 1906, (grassy ditch beside road in heavy deciduous forest), 1 ♀. St. Hilaire, Nièvres, August 17, 1906, (in short grass), 3 ♂, 3 ♀. Fort de l'Ecluse, Ain, August 20, 1908, 3 ♂, 1 ♀. Douvaine, Haute Savoie, August 14, 1906, (in dry grassy field), 4 ♂, 1 ♀. Evires, Haute Savoie, August 15, 1906, 1 ♂, 11 ♀.

Switzerland: Hermance, Geneva, August 14, 1906, (in dry grassy field), 16 ♂, 23 ♀. Zermatt, Valais, August 18, 1908, (in alpine herbage), 10 ♂, 15 ♀. St. Niklaus, Valais, August 19, 1908, 1 ♀. Münster, Rhone Valley, Valais, August 18, 1908, (in lush grasses), 4 ♀. Grimsel Hospice, Bernese Oberland, 6155 feet, August 17, 1908, (alpine herbage among great rocks), 11 ♂, 7 ♀. Thun, Bern, August 13, 1906, 3 ♂. Schwellenhöhe, Bernese Oberland, 5000 to 6000 feet, August 12, 1908, (abundant in alpine herbage, particularly above timber line), 5 ♂, 3 ♀. Wengernalp, Bern, August 12, 1906, (in small area of high grass), 1 ♂. Mount Pilatus, Unterwalden, 4950 feet, August 10, 1906, (in alpine herbage), 4 ♂, 3 ♀. Brunig Pass, Unterwalden, August 11, 1906, (on edge of grassy field), 1 ♀. Schlierenthal, Unterwalden, August 11, 1906, (in grass about bushes on edge of stream), 1 ♂. Kaiserstuhl, above Giswil, Unterwalden, August 11, 1906, (in high grass), 1 ♂, 1 ♀. Near Wiesen, Soleure, August 9, 1906, (in grasses among great rocks), 1 ♀. Frankendorf, Basle, August 9, 1906, (in grassy field), 1 ♂.

Italy: Milan, July 23, 1908, (in weeds in city), 3 ♀.

The Brighton, England, series is exceptionally depauperate, a pair measuring as follows: length of body, ♂ 11.8, ♀ 14.9; length of pronotum, ♂ 2.4, ♀ 2.9; length of tegmen, ♂ 7, ♀ 4.2; length of caudal femur, ♂ 7.7, ♀ 9.4 mm.

Chorthippus albomarginatus (DeGeer)

England: Hooe, Sussex, July 30, 1906, (occasional in marsh grass), 5 ♂, 4 ♀.

Holland: De Schermer, North Holland, July 21, 1908, 2 ♂, 6 ♀. The Hague, South Holland, August 26, 1906, (in short grass in park), 7 ♂, 8 ♀.

France: St. Hilaire, Nièvre, August 17, 1906, (in short grass beside road), 1 ♂. Tours, Indre et Loire, August 18, 1906, (among aquatic grasses and plants on river bank), 2 ♂, 5 ♀.

Chorthippus dorsatus (Zetterstedt)

France: Froissy, Aube, August 7, 1916, (in marsh), 2 ♀. Montigny, Meuthe et Moselle, August 8, 1906, (in high grass), 1 ♂. Douvaine, Haute Savoie, August 14, 1906, (in dry grassy field), 2 ♂.

Switzerland: Hermance, Geneva, August 14, 1906, (in dry grass field among swarms of grasshoppers), 46 ♂ 28 ♀. Zermatt, Valais, August 18, 1908, (in alpine herbage), 10 ♂, 16 ♀. St. Niklaus, Valais, 3708 feet, August 19, 1908, 3 ♂, 10 ♀. Münster, Rhone Valley, Valais, August 18, 1908, (in alpine grasses and herbage), 1 ♂, 1 ♀. Flesch, Rhone Valley, Valais, August 18, 1908, (in alpine grasses), 1 ♂.

Chorthippus pulvinatus (Fischer)

France: Lusigny, Aube, August 7, 1906, (in grass), 1 ♂, 3 ♀. Estissac-sur-Vanne, Aube, August 7, 1906, (in dry herbage), 3 ♂, 2 ♀. Pont-sur-Yonne, Yonne, August 6, 1906, (in roadside grasses), 12 ♂, 12 ♀. Clery, Loiret, July 20, 1906, 1 ♂, 2 ♀. Muides, Loire et Cher, August 20, 1906, 2 ♂, 1 ♀. Blois, Loire et Cher, August 20, 1906, 1 ♂. Tours, Indre et Loire, August 18, 1906, (the commonest species among the grasses and water plants on river bank), 5 ♂, 9 ♀. Chaumont sur Loire, August 20, 1906, 3 ♀. St. Hilaire, Nièvre, August 17, 1906, (in short grass beside road), 1 ♂. Ft. de l'Ecluse, Ain, August 20, 1908, 3 ♀. St. Cécile, Ain, August 21, 1908, (on bare heather covered hilltop), 3 ♂, 1 ♀.

Italy: Tomb of Maximus, near Rome, July 24, 1908, (in weedy field), 4 ♂, 7 ♀, 1 large juv. Santa Agnese, Rome, July 24, 1908, (on wet ground), 1 ♀. Villa Senni, near Rome, July 25, 1908, (on dry grassy hillside), 2♂, 4 ♀. Valle Violata, Alban Hills, Latium, July 27, 1908, (in grass), 2 ♂.

The female from Santa Agnese, Italy, alone has the tegmina extending almost to the apex of the abdomen, a very unusual degree of macropterism for this sex of the present species.

Striking general, though purely superficial, resemblance is shown to the North American *Opeia obscura* (Thomas).

Myrmeleotettix[6] **maculatus** (Thunberg)

England: Brighton, Sussex, July 28, 1906, (moderately common in short herbage of open flat country above coastal cliffs), 7 ♂, 6 ♀, 1 large juv. ♀.

Germany: Berlin, Brandenburg, August 26, 1906, 1 ♀.

France: Pont-sur-Yonne, Yonne, August 6, 1906, (in roadside grasses), 1 ♀. Chaumont, Haute Marne, August 7, 1906, (occasional on barren hillside near pine forest), 4 ♂, 3 ♀. Muides, Loire et Cher, August 20, 1906, 3 ♂, 5 ♀.

Gomphocerus rufus (Linnaeus)

France: La Guerche, Cher, August 17, 1906, (in undergrowth of heavy deciduous forest), 7 ♂, 1 ♀. Douvaine, Haute Savoie, August 14, 1906, (in drain bordering dry grassy field), 9 ♂, 1 ♀. Evires, Haute Savoie, August 15, 1906, (in dry grass field swarming with grasshoppers), 19 ♂, 4 ♀.

Switzerland: Brunig Pass, Unterwalden, 3200 feet, August 11, 1906, (as common as *Chorthippus* along border of dry grassy field), 4 ♂, 8 ♀. Giswil, Unterwalden, August 11, 1906, (in high grass of marshy meadow), 1 ♂, 3 ♀. Wiesen, Soleure, August 9, 1906, (among rocks at summit of pass), 2 ♂.

Italy: Monte Vallestre, Emilia, September 19, 1922, (C. Menozzi), 1 ♀. Rocka di Pape, Alban Hills, Latium, 1700 to 1800 feet, July 27, 1908, (in undergrowth of heavy hillside forest), 2 ♂, 2 ♀.

Gomphocerus variegatus (Fischer)

A single female of this local species, from Monte Cimone, Emilia, Italy, taken by C. Menozzi, is in the author's collection. Length of body, 19.7; length of pronotum, 3.9; length of tegmen, 5; length of caudal femur, 11.4 mm.

Gomphocerus sibiricus (Linnaeus)

Switzerland: Zermatt, Valais, August 18, 1908, (very common in alpine herbage on open mountain slopes) 69 ♂, 94 ♀.

Dociostaurus genei (Ocskay)

Italy: Villa Senni, near Rome, August 25, 1908, (on open dry grassy hillside), 5 ♂, 3 ♀.

[6] Though not followed by Chopard, we believe Bolivar is correct in separating *maculatus* from the genus *Gomphocerus*, see Trab. Mus. Nac. Cienc. Nat., Ser. Zool., no. 20, p. 61, (1914).

A superficial resemblance, striking in certain features, is shown to this species by the North American *Psoloessa texana* Scudder. Our field notes state, "They are much like *Psoloessa*, but are not as quick to take flight. This makes them even harder to capture, as one is apt to strike over and past them with the net."

Arcyptera fusca (Pallas)

SWITZERLAND: St. Niklaus, Valais, 3708 feet, August 19, 1908, 1 ♂. Münster, Rhone Valley, Valais, August 18, 1908, (locally common in rich alpine herbage in a boggy area), 16 ♂, 6 ♀.

Stethophyma grossum (Linnaeus)

FRANCE: Montigny, Meuthe-et-Moselle, August 8, 1906, (not common in meadow of high grass), 5 ♂.

SWITZERLAND: Hermance, Geneva, August 14, 1906, 1 ♀.

We have noted that, "The stridulation of this species much resembles that of the North American *S. lineatum* (Scudder)." In general appearance, also, these species show decided similarity.

Aiolopus strepens (Latreille)

ITALY: Santa Agnese, Rome, July 24, 1908, (in wet meadow), 3 ♂, 1 ♀.

Something about the general appearance of this genus somewhat suggests the North American genus *Encoptolophus*, while the species of both are partial to waste land.

Aiolopus thalassinus (Fabricius)

FRANCE: Tours, Indre et Loire, August 18, 1906, (in grasses on river bank), 1 ♂. St. Hilaire, Nièvre, August 17, 1906, (in short grass beside road), 1 ♂.

ITALY: Forum Romanum, Rome, August 26, 1908, (on almost bare dry soil), 1 ♂. Villa Senni, near Rome, July 25, 1908, (on dry grassy hillside), 1 ♀.

OEDIPODINAE

Psophus stridulus (Linnaeus)

SWITZERLAND: St. Niklaus, Valais, 3700 feet, 3 ♂.

Oedaleus nigrofasciatus (DeGeer)

FRANCE: St. Cécile, Ain, August 21, 1908, 2 ♂.

ITALY: Villa Senni, near Rome, July 25, 1908, (on dry grassy hillside), 1 ♂.

Oedipoda miniata (Pallas)

France: Champagne, Ain, August 16, 1906, (in dry grass at foot of rocks overgrown with bushes, the most vigorously flying species there found), 2 ♂, 6 ♀. Fort de l'Ecluse, Ain, August 20, 1908, 2 ♂. Gorge du Fier, Haute Savoie, August 15, 1906, 5 ♂, 1 ♀.

Switzerland: St. Niklaus, Valais, 3708 feet, August 19, 1908, 7 ♂, 9 ♀.

Oedipoda coerulescens (Linnaeus)

France: St. Dié, Vosges, August 8, 1906, (on grassy hillside), 1 ♂. Cléry, Loiret, August 20, 1906, 1 ♂. Muides, Loire et Cher, August 20, 1906, 2 ♂, 2 ♀, 1 juv. Blois, Loire et Cher, August 20, 1906, 1 ♂. La Guerche, Cher, August 17, 1906, (beside road in forest), 7 ♂, 6 ♀. St. Cécile, Ain, August 21, 1908, (among roadside weeds), 1 ♂, 1 ♀. Champagne, Ain, August 16, 1906, (in dry grass at foot of rocks overgrown with bushes), 1 ♀. Gorge du Fier, Haute Savoie, August 15, 1906, 9 ♂, 2 ♀.

Switzerland: Hermance, Geneva, August 14, 1906, (in dry grassy field), 4 ♂, 6 ♀. St. Niklaus, Valais, 3708 feet, August 19, 1908, 4 ♂, 1 ♀.

Italy: Tomb of Maximus, near Rome, July 24, 1908 (in weedy field), 2 ♂, 2 ♀. Santa Agnese, Rome, July 24, 1908, (in dry grassy area), 1 ♀. Villa Senni, near Rome, July 25, 1908, (in blackberry vines), 3 ♂, 1 ♀. Rocka di Pape, Alban Hills, Latium, 1700 to 1800 feet, July 27, 1908, (on hillside in forest), 3 ♂, 2 ♀.

Acrotylus insubricus (Scopoli)

Italy: Forum Romanum, Rome, July 26, 1908, (scarce on almost bare ground), 2 ♂, 1 ♀.

Sphingonotus coerulans (Linnaeus)

France: Amboise, Indre et Loire, August 19, 1906, 1 ♂. Gorge du Fier, Haute Savoie, August 15, 1906, (on rocks with hardly any vegetation), 8 ♂, 3 ♀.

Italy: Forum Romanum, Rome, July 26, 1908, (common, on almost bare dry soil), 6 ♂, 3 ♀.

CYRTACANTHACRINAE

Pezotettix[7] **giornae** (Rossi)

ITALY: Tomb of Maximus, near Rome, July 24, 1908, (in weedy field), 4 ♂, 6 ♀. Santa Agnese, Rome, July 24, 1908, (on wet uncultivated ground), 4 ♂, 6 ♀. Villa Senni, near Rome, July 27, 1908, 1 ♂, 6 ♀. Rocka di Pape, Alban Hills, Latium, July 25, 1908, (in undergrowth of hillside woodlands), 2 ♂, 1 ♀.

Podisma pedestris (Linnaeus)

SWITZERLAND: St. Niklaus, Valais, August 19, 1908, 1 ♂. Schwellenhöhe, Bernese Oberland, 5000 to 6000 feet, August 12, 1906, (common in open alpine vegetation up to timber line), 13 ♂, 9 ♀. 1 juv. ♀. Wengernalp, Bernese Oberland, August 12, 1906, (in small area of high grass), 3 ♂.

Podisma alpina (Kollar)

FRANCE: Col de la Schlucht, Vosges Mountains, Vosges, August 9, 1906, (on low huckleberry bushes in small open area in spruce forest; sluggish, their color, though brilliant, blending with their surrounding), 6 ♂, 6 ♀.

SWITZERLAND: Schwellenhöhe, Bernese Oberland, 5000 to 6000 feet, August 12, 1906, (common in open alpine vegetation up to timber line), 13 ♂, 11 ♀, 1 juv. ♀. Wengernalp, Bernese Oberland, August 12, 1906, (in small area of high grass), 1 ♂, 1 ♀. Mount Pilatus, Unterwalden, 4950 feet, August 10, 1906, (in alpine herbage), 3 ♂, 1 juv. ♂, 1 juv. ♀.

Calliptamus italicus (Linnaeus)

FRANCE: St. Hilaire, Nièvre, August 17, 1906, (in short roadside grasses), 1 ♂. Mâcon, Saone et Loire, August 16, 1906, 1 ♀. Bourg, Ain, August 16, 1906, (in grasses beside road), 1 ♂. Champagne, Ain, August 16, 1906, (numerous in dry grass at foot of rocks overgrown with bushes), 9 ♂, 6 ♀. Douvaine, Haute Savoie, August 14, 1906, (in field of dry grass), 2 ♂, 1 ♀.

SWITZERLAND: Hermance, Geneva, August 14, 1906, (in dry grassy field swarming with grasshoppers), 3 ♂, 11 ♀.

ITALY: Santa Agnese, Rome, July 24, 1908. 1 ♂.

[7] We have discussed this genus and the American genus of nearest relationship. Proc. Acad. Nat. Sci. Phila., LXXVI, p. 184, (1924).

TETTIGONIIDAE

Phaneropterinae

Leptophyes punctatissima (Bosc)

France: Mantua, Ain, August 20, 1908, (on hilltop in low bushes and heather), 1 ♂, 1 ♀. Bourg, Ain, August 16, 1906, (in hedge along field, quite inactive and did not attempt to jump), 1 ♀.

Anerota[8] **falcata** (Poda)

France: La Guerche, Cher, August 17, 1906, (on low shrubbery in deep deciduous forest), 1 ♂. Douvaine, Haute Savoie, August 14, 1906, (among swarms of grasshoppers in field of dry grass), 3 ♂, 7 ♀.

Anerota quadripunctata (Brunner)

France: Aix le Bains, Savoie, August 15, 1906, (taken at night on shrubbery, song a faint *errr-errr-errr*), 1 ♂.

Tylopsis thymifolia (Petagna)

Italy: Tomb of Maximus, near Rome, July 24, 1908, (in weedy field with high weed clumps), 6 ♂, 3 ♀, 1 juv. ♀.

Conocephalinae

Conocephalus fuscus (Fabricius)

France: Froissy, Aube, August 7, 1906, (in marsh), 1 ♂, 2 ♀. Montigny, Meuthe et Moselle, August 8, 1906, (in meadow of tall grass), 1 ♀. Tours, Indre et Loire, August 18, 1906, (in water grasses on river bank), 2 ♂. Fort de l'Ecluse, Ain, August 20, 1908, 1 ♀. Douvaine, Haute Savoie, August 14, 1906, (in drain along edge of dry grassy field among swarms of grasshoppers), 4 ♂, 6 ♀.

[8] We have commented on the necessity of using this name, proposed by Caudell, for the European genus long recognized as *Phaneroptera*, Proc. Acad. Nat. Sci. Phila., LXXIV, p. 171, footnote 36, (1922). No data has subsequently been found which would, in our opinion, warrant discarding the name *Anerota*, unfortunate as the selection of a genotype for *Phaneroptera* may, to some, seem to have been.

Tettigoniinae

Tettigonia viridissima (Linnaeus)

France: Beauvais, Oise, August 1, 1906, 6 ♂, 2 ♀. Pont-sur-Yonne, Yonne, August 6, 1906, 1 ♂. Nancy, Meuthe et Moselle, August 7, 1906, (in tall weeds), 1 ♂.

Switzerland: Aarburg, Aargau, August 9, 1906, (in grass), 2 ♂.

The song was noted as "a constantly repeated loud *zaa-zaa-zaa-zaa*, much like that of certain species of the American genus *Phaneroptera*, but more continuous."

Tettigonia cantans (Fuessly)

Germany: Hamburg, August 29, 1906, 2 ♂, 3 ♀. Triberg, Baden, August 9, 1908, (common in trees twelve to twenty feet above ground), 1 ♂.

Switzerland: Brunig Pass, Unterwalden, August 11, 1906, (in grass, common but very shy), 2 ♂.

We noted that this insect "keeps up a sometimes almost continuous *crrrrrrrrrrr*, the periods without break, however, usually lasting from eight to fifteen seconds. When approached nearer than ten feet, individuals at once ceased stridulating and dropped silently down into the grass."

Decticinae

Rhacocleis bormansi (Brunner)

Italy: Genoa, Liguria, September 20, 1919, (C. Menozzi), 1 ♀. Tomb of Maximus, near Rome, July 24, 1908, (in grasses in weedy field), 1 ♂, 3 juv. ♂, 2 juv. ♀. Villa Senni, near Rome, July 25, 1908, (on dry grassy hillside), 1 juv. ♀. Rocka di Pape, Alban Hills, Latium, 1700 to 1800 feet, July 27, 1908, (in woods and undergrowth), 3 juv. ♂, 1 juv. ♀.

Decticus verrucivorus (Linnaeus)

Germany: Berlin, Brandenburg, August 28, 1906, 1 ♂. Triberg, Baden, August 10, 1908, (very common, "jumps clumsily but as if in great alarm when approached"), 1 ♂.

France: Gerardmer, Vosges, August 8, 1906, (common in grass in openings of spruce forest), 7 ♂, 9 ♀. Above Sulzeren, Vosges Mountains, Alsace, August 9, 1906, (in opening of spruce forest), 1 ♂. Evires, Haute Savoie, August 15, 1906, 1 ♂, 1 ♀.

SWITZERLAND: Zermatt, Valais, August 18, 1908, 2 ♂, 2 ♀. Schwellenhöhe, Bernese Oberland, 5000 feet, August 12, 1906, (on grassy upland), 3 ♂. Brunig Pass, Unterwalden, August 11, 1906, (common in high grass with *Tettigonia cantans* (Fues.)), 1 ♂. 1 ♀. Goeschenen, Uri, July 23, 1908, (on grassy upland), 1 juv. ♀.

The stridulation of this large terrestrial katydid is scarcely louder than that of *Stauroderus biguttulus* (L.) and is a somewhat similar *sikkkk*.

Pholidoptera griseoaptera (DeGeer)

GERMANY: Berlin, Brandenburg, August 28, 1906, (undergrowth in pine woods), 1 ♂, 1 ♀.

FRANCE: Neufchateau, Vosges, August 7, 1906, (in tall grass, jumped vigorously), 1 ♂. Evires, Haute Savoie, August 15, 1906, (in dry grassy field), 2 ♂. Aix les Bains, Savoie, August 15, 1906, (taken at night on shrubbery, stridulation faint), 1 ♂.

SWITZERLAND: Schlierenthal, near Schlieren, Unterwalden, August 11, 1906, (in grass about bushes on edge of stream), 2 ♂.

ITALY: Rocka di Pape, Albau Hills Latium. 1700 to 1800 feet, July 27, 1908, (on path in woods), 1 ♂.

The last record is of interest, as Chopard has stated that its distribution covered, "All of France excepting, probably, the Mediterranean region" and Brunner gave as its southern limits Istria and Mehadia, Serbia.

Metrioptera albopunctata (Goeze)

FRANCE: Pont-sur-Yonne, Yonne, August 6, 1906, (in grass on roadside), 3 ♂, 1 ♀. Estissac sur Vanne, Aube, August 7, 1906, (in dry herbage), 1 ♂. Chaumont, Haute Marne, August 7, 1906, (on barren hillside near pine forest), 1 ♀. Nancy, Meuthe et Moselle, August 7, 1906, (in weedy area), 1 ♂. Fort de l'Ecluse, Ain, August 20, 1906, 1 ♀. Douvaine, Haute Savoie, August 14, 1906, (in dry grassy field swarming with grasshoppers) 3 ♂, 1 ♀. Gorge du Fier, Haute Savoie, August 15, 1906, 1 ♂.

SWITZERLAND: Hermance, Geneva, August 14, 1906, (in dry grassy field among swarms of grasshoppers), 6 ♂, 4 ♀. St. Niklaus, Valais, 3708 feet, August 19, 1908, 1 ♂, 3 ♀. Grengiols, Valais, August 19, 1908, (in lush alpine herbage), 1 ♀. Above Meiringen, Haslithal, Bern, August 17, 1908, 1 ♀.

Metrioptera affinis (Fieber)

ITALY: Tomb of Maximus, Rome, July 24, 1908, (in dry weedy field with clumps of tall weeds), 1 ♂, 3 ♀.

Metrioptera tessellata (Charpentier)

FRANCE: Pont-sur-Yonne, Yonne, August 6, 1906, (in roadside grasses), 7 ♂, 3 ♀. Blois, Loire et Cher, August 20, 1906, 1 ♀. Muides, Loire et Cher, August 20, 1906, 1 ♀. Tours, Indre et Loire, August 18, 1906, (among water grasses on river bank), 3 ♂, 1 ♀.

ITALY: Tomb of Maximus, near Rome, July 24, 1908, (in dry weedy field with clumps of tall weeds), 3 ♂, 6 ♀. Villa Senni, near Rome, August 25, 1908, (on dry grassy hillside), 1 ♂.

Metrioptera brachyptera (Linnaeus)

FRANCE: Samer, Pas-de-Calais, July 31, 1906, (in roadside grasses), 2 juv. ♂, 2 juv. ♀.

Metrioptera abbreviata (Serville)

FRANCE: Col de la Schlucht, Vosges Mountains, Vosges, August 9, 1906, (abundant in a small opening in the spruce forest overgrown with huckleberry bushes), 1 ♂, 3 ♀.

SWITZERLAND: Wengernalp, Bernese Oberland, August 12, 1906, (in a small plot of high grass), 1 juv. ♀. Schlierenthal, Unterwalden, August 11, 1906, (in grass about bushes on edge of stream), 1 ♀. Mount Pilatus, Unterwalden, 4950 feet, August 10, 1906, (above and at timber line in sparse alpine herbage), 5 ♂, 2 ♀, 6 juv.

This species has been confused with *M. brachyptera* (Linnaeus), as is shown by a specimen before us from the Alps, sent by Saussure as that species, as well as a specimen labelled *saussureana* (= *abbreviata*).

Metrioptera bicolor (Philippi)

GERMANY: Berlin, Brandenburg, August 28, 1906, (in pine forest), 1 ♂.

Metrioptera roeselii (Hagenbach)

FRANCE: Beauvais, Oise, August 1, 1906, 3 ♂, 1 ♀. Pont-sur-Yonne, Yonne, August 6, 1906, (in roadside grasses), 1 ♂, 1 ♀. Montigny, Meuthe et Moselle, August 8, 1906, (in a meadow of tall grass), 5 ♂. St. Dié, Vosges, August 8, 1906,

(on grassy hillside), 2 ♀. Gerardmer, Vosges, August 8, 1906, (very common in tall grass in openings of spruce forest), 5 ♂, 7 ♀, (1 ♂ with caudate tegmina and wings). Col de la Schlucht, Vosges Mountains, Vosges, August 9, 1906, (one only taken in small grassy opening in spruce forest where *M. abbreviata* (Serv.) was abundant), 1 ♂, (with caudate tegmina and wings). Above Sulzeren, Vosges Mountains, Alsace, August 9, 1906, (open field in spruce forest), 1 ♂. Fort de l'Ecluse, Ain, August 20, 1908, 2 ♀. Evires, Haute Savoie, August 15, 1906, (in dry grassy field swarming with grasshoppers), 2 ♂.

SWITZERLAND: Hermance, Geneva, August 14, 1906, (in dry grassy field swarming with grasshoppers), 1 ♀. St. Niklaus, Valais, 3708 feet, August 19, 1908, 1 ♂, 2 ♀. Thun, Bern, August 13, 1906, 1 ♂. Schlierenthal, near Schlieren, Unterwalden, August 11, 1906, (in grasses about bushes near stream), 1 ♀, (with caudate tegmina and wings). Giswil, Unterwalden, August 11, 1906, (in high meadow grass in boggy environment), 1 ♀. Kaiserstuhl above Giswil, Unterwalden, August 11, 1906, (in tall grass), 1 ♂, 2 ♀. Near Wiesen, Soleure, August 9, 1906, (in pass before Olten, on roadside in plants among great rocks), 2 ♀.

Our notes state that the stridulation of this species is "much like that of certain species of the North American genus *Orchelimum*, but much fainter."

Metrioptera sepium (Yersin)

ITALY: Tomb of Maximus, near Rome, July 24, 1908, (in clump of tall weeds in dry weedy field), 2 ♀.

EPHIPPIGERINAE

Ephippigera ephippiger (Fiebig)

FRANCE: Chambord, Loire et Cher, August 20, 1906, 1 ♂. Cléry, Loiret, August 20, 1906, 1 ♂. Ceignes, Ain, August 16, 1906, (stridulating in sunshine), 1 ♂. Abergement, Ain, August 16, 1906, (stridulating in bushes in sunshine), 1 ♂.

GRYLLIDAE

Oecanthinae

Oecanthus pellucens (Scopoli)

France: Lusigny, Aube, August 7, 1906, 3 ♀.

Nemobiinae

Nemobius sylvestris (Bosc)

France: La Guerche, Cher, August 17, 1906, (among dead leaves and moss under dense undergrowth of heavy deciduous forest), 2 ♂, 3 ♀.

Switzerland: St. Niklaus, Valais, 3708 feet, August 19, 1908, 2 ♂, 1 ♀.

The Swiss specimens are much darker than any others before us, the general coloration being blackish brown, with disk of pronotum showing only limited slightly paler areas.

Gryllinae

Acheta campestris (Linnaeus)

France: Evires, Haute Savoie, August 15, 1906, (in dry grassy field swarming with grasshoppers), 1 juv. ♂.

Gryllus domesticus (Linnaeus)

France: Boubon Lancy, Saone et Loire, August 16, 1906, (in cracks in cement, very active at night, stridulating vigorously), 3 ♂, 3 ♀.

Gryllomorpha dalmatina (Ocskay)

Italy: Castelvetro, Emilia, September, 1922, (C. Menozzi), 1 ♀. Grotta della Scaglia, Prato, Liguria, January 24, 1920, (C. Menozzi), 1 juv. ♀.

Mogoplistinae

Mogoplistes brunneus (Serville)

Italy: Rocka di Pape, Alban Hills, Latium, 1750 feet, July 27, 1908, (on low plant in dark woods), 1 ♀.

Material from Hyères, Var, France, presented to the Academy by de Saussure as this species, is found to represent instead *M. squamiger* (Fischer).

This paper is presented that the records may be available for more detailed studies of the distribution of European species, and that it may serve as an index of the forms which the visitor, interested in Orthoptera, is liable to encounter in parts of Europe during a brief visit.

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HEBARD—TAENIOPODAE IN THE UNITED STATES

Fig. 1. Wash of Sycamore Canyon, looking westward toward Baboquivari Peak. Pima County, Arizona. Habitat of *Taeniopoda eques* (Burmeister) and many other interesting species.

Fig. 2. *Taeniopoda eques* (Burmeister), in acacia near Espinosa Rancho, flats of the Altar Valley. Pima County, Arizona.

THE GENUS ANCISTROCERUS (HYMENOPTERA, VESPIDAE) IN NORTH AMERICA, WITH A PARTIAL KEY TO THE SPECIES

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The genus *Ancistrocerus* is one of the most difficult of all folded-winged wasps so far as the discrimination of species is concerned. The European forms were clearly defined at a rather recent period by C. G. Thomson, in 1874. In North American collections, the specimens are usually left undetermined or the few names occasionally given are not reliable. The species included in H. de Saussure's Synopsis of American Wasps (1875) may nearly all be recognized after a careful study of the excellent descriptions. The author evidently disposed of a small collection (probably not over 200 specimens from the eastern United States), so that in so difficult a group one can but marvel at his taxonomic acumen. Unfortunately his keys are almost totally based upon color and, in addition, contain some manifest errors: they must have deterred many a beginner. Most of the later work has consisted of disconnected descriptions of supposedly new species. Outstanding among them, for their number as well as for their poor quality, are those contributed by P. Cameron, which for many years to come will remain a stumbling-block in the study of the western forms. C. Robertson's paper of 1901,[1] on the other hand, is a contribution of real value, calling attention to a number of structural peculiarities which are of considerable help in the separation of closely allied species. His descriptions are models of the kind.

I have at various times attempted to draw up a key that would permit a fairly accurate identification of the *Ancistroceri* found in the eastern United States and have now reached the point where its publication seems warranted. I am well aware, however, that it is still unsatisfactory in many respects. Yet it marks, I

[1] Trans. Amer. Ent. Soc., XXVII, pp. 195–204.

believe, some progress on what has gone before and, furthermore, its publication will enable others to point out its deficiencies and further extend or improve it.

I have studied the collections of the Boston Society of Natural History, the Museum of Comparative Zoölogy at Cambridge, the Academy of Natural Sciences of Philadelphia, the Department of Entomology of Cornell University, and the Brooklyn Institute of Arts and Sciences. Specimens have also been submitted for study by Messrs. W. T. Davis, L. H. Taylor, and J. E. Smith. I wish to thank these gentlemen and also Professor J. C. Bradley, Mr. C. W. Johnson, Mr. Nathan Banks, and Mr. E. T. Cresson, Jr., for allowing the examination of the material in their care. So far as traceable, the collector's name has been inserted after each record.

The measurements of length indicated by the formula h. + th. + t. 1 + 2, are taken from the front of the head to the apex of the second tergite, the body being supposed stretched out horizontally and the head placed in the normal, vertical position.

Limits of Ancistrocerus

The only character separating *Ancistrocerus* from *Odynerus* resides in the presence in the former of a raised transverse carina separating the posterior portion of the first tergite from the anterior slope. Unfortunately, in certain species thif peculiarity is not as clearly marked as one might wish for a proper definition of the two genera. There appear to be two distinct groups of doubtful species. In the first, which includes the North American *A. quadrisectus* (Say), the carina is visible on the sides and effaced in the middle of the tergite. These wasps appear to be losing the carina and are therefore perhaps not properly speaking transitional to *Odynerus*. Yet Zavattari regards them as true *Odynerus*, a view which may well be defended. A second group of species, of a quite different type, includes the allies of *A. fulvipes* (Saussure), being part of my subgenus *Parancistrocerus*. Here the carina appears to be a recent acquisition and we find all passages to true *Odynerus*, namely to the group of *O. conformis* Saussure (Saussure's section *Stenodynerus*). In both *Parancistrocerus* and *Stenodynerus*, the general shape of the body is the same, the second sternite usually bears a deep, longitudinal

furrow, the hind margin of the first tergite frequently covers a mite-chamber or acarinarium, and several of the species possess elongate swellings along the inner margins of the posterior ocelli.

From the foregoing remarks it is clear that the dividing line between *Ancistrocerus* and *Odynerus* is entirely a matter of personal appreciation. In the present paper I have included in *Ancistrocerus* all species that show at least an appreciable trace of carina; sometimes it is present on the sides only, or it may be a slightly salient irregular line, set off by a row of deep punctures, and visible only when the insect is held in the proper position. My chief purpose in including these less typical forms is to reduce the number of species of *Odynerus*, which genus still contains the overwhelming majority of Eumeninae. Moreover, *Ancistrocerus* as at present understood is evidently polyphyletic, and one might well raise the question whether a more natural grouping of the species could not be reached by wholly disregarding the presence or absence of the transverse carina, at least in *Parancistrocerus* and *Stenodynerus*.

The transverse carina is evidently a structure acquired independently in several lines of descent among the Eumeninae, thus affording a good example of parallel development or convergence. *Ancistrocerus* proper may be regarded as derived from *Odynerus* subgenus *Rygchium* Spinola (= *Leionotus* H. de Saussure), *Subancistrocerus* being an offshoot of that branch; and the subgenus *Parancistrocerus* from *Odynerus* subgenus *Stenodynerus*. *Nortonia* may have arisen from certain forms of *Pachymenes*, and *Alastoroides* from *Alastor*. *Symmorphus* I am inclined to regard as a specialized branch of *Ancistrocerus* proper, although it is a much better defined group than any of the others and, in addition, is mainly, if not exclusively, Holarctic. It is of interest that the transverse carina of the first tergite is disappearing in certain species of *Symmorphus* too, as exemplified by the European *S. murarius* (Linnaeus).

While this structural peculiarity has thus become part of the common heritage of several groups of allied species, yet it is by no means clear what is its use or utility for the species or the individual. It appears to be merely one more of the many purposeless structures of common occurrence among insects. It might be possible to devise an alleged use for the carina, such as

that of strengthening the exoskeleton at the point of attachment of the muscles that hinge the second segment upon the first. I doubt, however, whether it could be shown that species possessing the structure are better fitted for their life work than the many other solitary wasps which lack it. There is but little difference in behavior and habits between the several species of *Symmorphus*, *Ancistrocerus*, and *Odynerus*, and certainly none that might be correlated with the presence or absence of a transverse carina on the first abdominal tergite.

The differentiation of *Ancistrocerus* and *Nortonia* is likewise sometimes a source of trouble, since the last-named genus evidently connects *Ancistrocerus* with *Eumenes*.[2] Fortunately the difficulty is not met with in the North American fauna, which, I believe, possesses no true *Nortonia*. The few Nearctic species that have been referred to that genus are in my opinion *Pachymenes*, since they have no transverse carina on the first tergite. All Eumeninae with transverse carina and sessile second cubital cell which I have seen from North America belong either to *Ancistrocerus* or to *Symmorphus*, the discrimination between these two presenting no real difficulty, in my experience.

Subdivisions of Ancistrocerus

H. de Saussure has at various times proposed to divide *Ancistrocerus* into a series of sections, some of which appear to correspond to fairly natural groups of species. As there is some confusion with regard to the proper application of these names, the following critical notes may be of use to other students.

1. *Ancistrocerus* (proper) Wesmael.[3] Type by designation of Ashmead:[4] *Vespa parietum* Linnaeus, 1758.

Westwood (1840) designated *Vespa parietina* Linnaeus, 1761, as the type,[5] but that species was not originally included by Wesmael in *Ancistrocerus*, which at that time contained only *oviventris* Wesmael, *parietum* Linnaeus, *trifasciatus* Fabricius, and *antilope* Panzer. *A. parietinus* (Linnaeus) has been re-

[2] See J. Bequaert, Bull. Amer. Mus. Nat. Hist., xxxix, 1918, pp. 90–94.

[3] Bull. Ac. Sci. Bruxelles, iii, 1836, p. 45 (as a subgenus of *Odynerus*). Westwood, Introd. Modern Class. Insects, ii, Synopsis, 1840, p. 84 (as a genus).

[4] Canad. Entom., xxxiv, 1902, p. 209.

[5] That Westwood intended to designate typical species of each genus is evident from the footnote, p. 1 of the Synopsis.

garded as a synonym of *A. parietum*, and I have done so formerly; but at present I believe that the two are specifically distinct, although quite closely allied.

Euancistrocerus Dalla Torre,[6] is but a new and totally unnecessary name for *Ancistrocerus*, proper. Zavatteri credits it to de Saussure, but that author has never used it.

2. *Subancistrocerus* H. de Saussure.[7] Three species are described in 1856, and of these the first, *Odynerus sichelii* Saussure, 1856, of the East Indies, is herewith designated as the type.

Syn.: *Epancistrocerus* H. de Saussure.[8] Type by present designation: *Odynerus sichelii* Saussure, 1856.

The group is quite well characterized by the presence of *two* transverse carinae on the first tergite.

3. *Ancistroceroides* H. de Saussure.[9] Only two species are described in 1856, and of these I designate the first, *Odynerus cruentus* Saussure, 1856, of Australia, as the type.

The section was established for species having the second cubital cell subpedunculate and thus forming transition to *Alastoroides*. But I believe, with Zavattari,[10] that this character is of no real value. It might therefore be best to unite *Ancistroceroides* with *Ancistrocerus*, proper.

4. *Pararrhynchium* H. de Saussure.[11] Type by monotypy: *Rhynchium ornatum* F. Smith, 1852, of China.

Since that species possesses a transverse, though low and blunt carina on the first tergite, it should be included in *Ancistrocerus*. A. v. Schulthess[12] has done so and he places it, with other allied Oriental species, in the subgenus *Hypancistrocerus*. *Odynerus advena* Saussure is the type of *Hypancistrocerus* and is not related to *Rhynchium ornatum*.

[6] Gen. Insect., Vesp., 1904, p. 36.

[7] Et. Fam. Vesp., III, 1856, p. 206 (as a section of the subgenus *Ancistrocerus*, to correspond to the "I^re^ Division" of the first volume of the "Etudes," p. 126).

[8] Et. Fam. Vesp., III, 1856, p. 352 (in errata; substitute for *Subancistrocerus*).

[9] Et. Fam. Vesp., III, 1856, p. 221 (as a section of the subgenus *Ancistrocerus*, corresponding to the "III^e^ Division" of the first volume of the "Etudes," p. 146).

[10] Arch. f. Naturgesch., LXXVIII, abt. A, heft 4, 1912, p. 174.

[11] Et. Fam. Vesp., III, 1856, p. 173 (as a section of the genus *Rhynchium*).

[12] Ark. f. Zool., VIII, no. 17, 1913, p. 8.

5. *Hypancistrocerus* H. de Saussure.[13] Type by monotypy: *Odynerus advena* Saussure, 1856, of Brazil.

Zavattari states that *A. advena* has thirteen antennal segments in the female and fourteen in the male. I have had occasion to examine, at the British Museum, the type of that species, a female from Santarem, Brazil; also a male from Santarem, a male from Villa Nova, Brazil, and a female from "Brazil." I have found that the antennae are twelve-segmented in the female and thirteen-segmented in the male, as in other species of *Ancistrocerus*. The pedicel, however, between the flagellum and the scape, is much longer than usual and somewhat constricted before the base, making it appear divided into two under a simple lens; but no real division nor articulation is to be seen. The antennal hook (apical segment) of the male is thickened at base, with pointed apex. The carina of the first tergite forms a sharp ridge. The horizontal portion of the propodeum is short, yet quite distinct behind the postscutellum.

In 1863, H. de Saussure[14] extended *Hypancistrocerus* to include, besides *O. advena*, a number of African species. But the name, if used at all, must be applied to the section that contains *O. advena*.

6. *Pseudodynerus* H. de Saussure.[15] The only species mentioned in 1856 is *Odynerus luctuosus* Saussure, 1856, and this is herewith designated as type. In a footnote, however, de Saussure states that this division corresponds to the second section of the subgenus *Ancistrocerus* in the first volume of the "Etudes" (p. 145). Later[16] de Saussure eliminated *O. luctuosus* from the group, transferring it to *Stenodynerus;* while he made *Pseudodynerus* to cover the "Group of the *O. quadrisectus*," including only *A. aztecus* (Saussure) and *A. quadrisectus* (Say).

O. luctuosus was described as doubtfully from South Carolina, but the species has never been found in North America and

[13] Et. Fam. Vesp., III, 1856, p. 222 (as a section of the subgenus *Ancistrocerus*). Zavattari, Arch. f. Naturgesch., LXXVIII, abt. A, heft 4, 1912, p. 209 (as a subgenus of *Odynerus*).

[14] Mém. Soc. Phys. Hist. Nat. Genève, XVII, pt. 1, p. 210.

[15] Et. Fam. Vesp., III, 1856, p. 220 (as a section of *Ancistrocerus*, corresponding to the "section 2e" of the first volume of the "Etudes," p. 145). Zavattari, Arch. f. Naturgesch., LXXVIII, abt. A, heft 4, 1912, p. 237 (as a section of the subgenus *Leionotus* of *Odynerus*).

[16] Synopsis of American Wasps, 1875, p. 192.

Zavattari has recognized it as a wasp of Colombia. If Zavattari's interpretation be correct (and I have no reason to doubt it), *O. luctuosus* is evidently allied to *O. quadrisectus*. These two species, together with a number of allied South American forms, should all be included in *Pseudodynerus*, characterized by a quite indistinct transverse carina of the first tergite and the propodeum forming a horizontal area behind the postscutellum. Brèthes and Zavattari include *Pseudodynerus* in *Odynerus* rather than in *Ancistrocerus*, which is plainly a matter of personal liking.

7. *Stenancistrocerus* H. de Saussure.[17] Type by present designation: *Odynerus atropos* Lepeletier, 1841, of North Africa.

When de Saussure established *Stenancistrocerus* in 1863 to cover the group of *O. atropos*, the following American species had been referred to that section: *O. atropos* Lepeletier;[18] *O. ambiguus* Spinola, *O. scabriusculus* Spinola, *O. bustillosi* Saussure, *O. saecularis* Saussure, *O. fulvipes* Saussure (1856) (= *O. flavipes* Lepeletier, 1852, not of Fabricius), *O. pedestris* Saussure (1856) (= *O. fuscipes* Saussure, 1852), *O. incommodus* Saussure, *O. ammonia* Saussure;[19] *O. conformis* Saussure, *O. anormis* (Say) (= *O. oculatus* Say);[20] *O. farias* Saussure, *O. bravo* Saussure, *O. proximus* Saussure, *O. arista* Saussure, *O. occidentalis* Saussure, *O. sumichrasti* Saussure, *O. guzmani* Saussure.[21] In 1863, de Saussure added one African species, *O. inconstans* Saussure and one of Mesopotamia, *O. turca* Saussure.

It will be noticed that *Stenancistrocerus* originally was a fairly composite group. Some of the names included in the foregoing list were later eliminated as synonyms; other species were transferred by de Saussure to *Ancistrocerus* proper (*O. ambiguus* = *O. bustillosi* and *O. arista* = *O. aristae* Saussure) or to the section *Stenodynerus* of *Odynerus* (*O. pedestris*, *O. conformis*, and *O. anormis*) and quite rightly so. It seems therefore necessary to define the name by a strict designation of type and I believe that *Odynerus atropos* Lepeletier should be selected as such.

[17] Mém. Soc. Phys. Hist. Nat. Genève, XVII, pt. 1, 1863, p. 216 (as a section of the subgenus *Ancistrocerus*, for the group of *Odynerus atropos*); Synopsis of American Wasps, 1875, p. 189 (as a section of *Ancistrocerus*).

[18] In Et. Fam. Vesp., I, 1852, p. 134.

[19] In Et. Fam. Vesp., I, 1852, p. 140.

[20] In Et. Fam. Vesp., III, 1856, p. 219.

[21] In Rev. Mag. Zool., (2), IX, 1857, pp. 274–275.

I have examined five females of *A. atropos* taken at Biskra, Algeria, and find that, although it has much the general appearance of the North American species related to *A. fulvipes* (Saussure), it differs in many important particulars: the first abdominal tergite is much shorter and wider, shaped almost as in *Ancistrocerus* proper; the hind margin is not in the least produced and covers no acarid chamber at the base of the second tergite; the transverse carina is quite sharp and distinct, nearly straight, making the posterior area rectangular in outline. The second sternite is quite flat, without trace of a basal longitudinal furrow. The propodeum is extremely short, with all its edges broadly rounded off, its concavity quite shallow, almost indistinct; there is no visible horizontal upper portion behind the postscutellum, the hind portion of which is already included in the vertical slope of the thorax. The parapsidal furrows are quite strong and run to the anterior margin of the mesonotum. The clypeus of the female is tridentate, being deeply emarginate, with a median tooth. The antennae are short and strongly club-shaped. *A. hispanicus* Dusmet, although differing in the clypeus and second sternite, evidently belongs to the same group.

Since I believe that *A. atropos* has no close relatives in North America, while the American species placed by de Saussure in *Stenancistrocerus* form a peculiar group of subgeneric rank, I feel justified in introducing a new name for it.

8. **Parancistrocerus** new subgenus. Type: *Odynerus fulvipes* Saussure, 1856 (= *O. flavipes* Saussure, 1852, not of Fabricius).

Body slender, cylindrical. First abdominal segment elongate; the tergite lengthened in the middle, convexly swollen, cup- or bell-shaped; its hind margin in most species covering a basal concavity or depression of the second tergite which forms a mite-chamber or acarinarium (sometimes empty); the transverse carina curved and often indistinct; the posterior area longer in the middle than on the sides and not rectangular, but rather elliptical in outline. Second sternite as a rule with a distinct and profound, longitudinal furrow at base. Propodeum elongate, generally with a deep concavity and with a quite short, though distinct, horizontal portion, which is depressed in the middle and separates the postscutellum from the concavity. Postscutellum still included in the horizontal, upper face of the thorax or slightly sloping as a whole; not divided into a horizontal, anterior and a vertical, posterior area. Parapsidal furrows of mesonotum absent or distinct near the scutellum only.

The group is mainly developed in North America, where it extends into Mexico. *Ancistrocerus zairensis* J. Bequaert, of the Ethiopian Region, should also be referred to it.

The above divisions are chiefly of interest because they appear to be geographically segregated. Since, in addition, they are generally well defined and correspond to fairly natural groups of species, some at least may be regarded as valid subgenera. The only groups represented in North America are *Ancistrocerus*, proper, *Pseudodynerus*, and *Parancistrocerus*. *Pseudodynerus* appears to be strictly American and I have seen no Old World species that could be referred to it. *Ancistrocerus*, proper, on the other hand, is much more widely distributed, since it is the common type of the Nearctic and Palaearctic Regions and some of the African species, such as *A. neavei* (Meade Waldo), *A. zebra* (Saussure), *A. lufirae* (Meade Waldo), etc., should also be included. Most of the African forms, however, are found at high altitudes only. *Parancistrocerus* has not been found in Europe and the American species are not closely related to any of the Old World.

Life History and Behavior

The species of *Ancistrocerus* are all strictly solitary and predaceous wasps. The female attends alone to the progeny and constructs a series of cells. After each cell is completed, a single egg is laid inside, suspended by a filament from the ceiling. A number of paralyzed larvae of insects are then hurriedly stored with the egg and the cell is closed before the egg has had time to hatch. Such a rapid procedure in storing the cell with food for the young is what Roubaud has called *mass provisioning*, and there are no examples known in *Ancistrocerus* of any marked departure from that type. Caterpillars, usually of small size, are preferred as prey; more rarely larvae of phytophagous beetles or of saw-flies are stored. The wasps thus destroy considerable numbers of noxious insects and consequently are extremely useful to man. Owing to the labor involved in construction and provisioning, the number of cells built by each female is always small, rarely over a dozen and often less. As in many other solitary wasps there is a tendency for the female to lay female-producing eggs first in the series (Verhoeff's proterothesis). The male-producing eggs are generally laid in cells that are smaller

and contain less provisions, although the sex of the young is determined by the nature of the egg laid by the mother-wasp and not by the amount of food. The size of the offspring, however, is regulated by the size of the cell and by the amount of provisions, which both depend upon a number of external circumstances as well as upon variations in the behavior of the mother-wasp. We may therefore expect within specific limits a greater range of variation in size than is usual among insects, although the males will be on the whole smaller than the females. It should also be noted that the males, though actually younger than the females, quite generally hatch first from the nest (protandry).

The architecture of the nest shows some diversity, but varies within narrow limits for each species. The simplest type consists of a gallery burrowed in the soil or in a mud-wall, the successive chambers being merely separated by mud partitions; often too, use is made of hollow reeds or pre-existent galleries in wood, burrowed by various insect larvae, or even of wasp nests of the preceding year built by the same or by other species; certain species have a predilection for excavating the pit of briars and rose stalks or for accommodating the interior of old insect galls. Very few of the *Ancistroceri* have become true potter wasps, constructing clay cells in lumps that are freely attached to branches, to the bark of tree trunks or to stones (*A. oviventris* Wesmael and *A. birenimaculatus* Saussure). No species of the genus are known to build a clay chimney at the entrance of the nest, as is done by some of the *Odynerus*.

The habits of the North American species have been but little studied thus far. More or less complete observations have been published for the following: *A. unifasciatus* (Saussure), *A. capra* (Saussure), *A. birenimaculatus* (Saussure), *A. parietum* (Linnaeus), *A. albophaleratus* (Saussure), *A. campestris* (Saussure), *A. tigris* (Saussure), *A. quadrisectus* (Say), *A. fulvipes* (Saussure), and *A. saecularis* (Saussure).

In most species of the subgenus *Parancistrocerus* the abdomen possesses a peculiar chamber or cavity, as a rule densely filled with mites, which is present in both sexes. It is similar in location and structure to that found in certain North American *Odyneri* of the subgenus *Stenodynerus* de Saussure[22] (such as *O. pedestris*

[22] In the sense of H. de Saussure, Synopsis of American Wasps, 1875, p. 301. Whether this is the correct use of the name *Stenodynerus* I am unable to state at present.

Saussure, *O. anormis* Say, and *O. collega* Saussure) and the European *O. delphinalis* Giraud. It is essentially formed by a saddle-shaped depression of the neck of the second tergite which is partly covered by the much enlarged basal lamella; while the elongate and quite convex hind portion of the first tergite covers it like a roof. When the abdomen is stretched out straight, the first tergite encloses the mite chamber completely so that the mites are nearly all hidden from sight. There is no slit nor groove leading into the cavity, such as I have described for certain African wasps that possess a similar mite chamber in the abdomen.[23]

W. Roepke[24] has suggested the term "acarinarium" for the mite chamber of certain carpenter bees, which might be employed for that of other insects too. A new name is perhaps superfluous, since these structures are evidently analogous to the "acarodomatia" of plants. In both cases they are cavities variously placed or constructed according to the species, but quite hereditary, so as to afford characters of great taxonomic value. They have apparently no other use than to serve as abodes to acarids. Whether the mites are merely parasites or worthless messmates, or whether they are of some utility to the plant or the insect on which they live, is open to discussion, although the first view appears the most probable.

I have noticed an acarinarium in the following North American species, all of the subgenus *Parancistrocerus*: *A. fulvipes* (Saussure), *A. saecularis* (Saussure), *A. proximus* (Saussure), *A. bifurcus* (Robertson), and *A. histrio* (Lepeletier).

A Partial Key to the North American Species

The following key includes the species of the eastern United States which I have recognized in the material studied. *A. histrio* has been included following Robertson's interpretation. Of strictly western species I have added *A. tuberculocephalus*, *A. sutterianus*, and *A. navajo*. From the characters given the several other western species which I have seen will be recognized as distinct.

[23] Bull. Amer. Mus. Nat. Hist., xxxix, 1918, pp. 104, 106, and 115.
[24] Tijdschr. v. Entom., lxiii, 1920, versl., p. xiv.

I have not restricted the key to a few supposedly "salient" characters, but rather intended to include all peculiarities that might help in the discrimination of the species. The prospective student will soon discover that none are superfluous, but rather find them insufficient. There is apparently no easy method of identification in this genus, and I have personally not yet reached the point where I feel able to identify to my own satisfaction every specimen, much less to name the species offhand. Perhaps others will be more fortunate. Meanwhile I should advise the beginner to assemble as large a series as possible of specimens before attempting to use the key. If any doubt is felt as to the presence or absence of a transverse carina on the first tergite, it will be best to regard such specimens, provisionally at least, as belonging to *Odynerus*.

Of the species of the northeastern United States, *A. quadrisectus*, *A. unifasciatus*, *A. birenimaculatus*, and *A. capra* are most easily recognized. *A campestris* and *A. spinolae* are rare and respectively similar to *A. unifasciatus* and *A. capra*. *A. albophaleratus* and *A. waldenii* are quite similar in color, but the first-named is on the whole smaller and also the more common of the two. The group *Parancistrocerus* is rare north of Virginia, since most of the specimens that look superficially like it turn out to be *Odynerus*. The greatest difficulty will arise with *A. tigris* and *A. catskillensis*: these two species occur together and are really quite distinct. I have never seen intermediate specimens. Yet the differences are of degree only, and as such are not readily expressed in words. *A. tigris* is by far the more common of the two.

As in other genera of Diploptera, the species can only be properly understood after a thorough study of the morphology. I regret that I was not able to eliminate the color characters entirely from the key. Although I do not doubt that certain species possess a distinctive livery, it is often subject to considerable variation and the student must be warned against trusting it too much.[25] I am not in the least convinced that the ferruginous-red instead of yellow markings and the presence or absence of lateral spots on the second tergite are of real specific value in the sub-

[25] One should not be deceived by post-mortem changes in color, which are only too frequent in collections. The yellow readily turns reddish when the insect is exposed too long to the fumes of cyanide; while it frequently fades to nearly white in specimens that have been preserved in alcohol.

genus *Parancistrocerus*, as might appear from the key. I have merely followed common usage in employing these characters, because of the lack of extensive series on which to base an independent opinion.

1. Propodeum with a long, horizontal, basal portion, on a level with the postscutellum and separated from the abruptly vertical posterior face by a sharp, crenulate carina, which is deeply and broadly notched in the middle. Superior, inferior, and lateral ridges and lateral angles of the propodeum rounded, blunt. First abdominal tergite with the transverse carina feebly raised on the sides, effaced in the middle; the posterior area much broader than long, nearly rectangular, with a median, longitudinal, depressed line. Second tergite slightly swollen, somewhat tuberculate. Vertex in the female with a broad flattened area bearing two dense patches of brownish pile. Shiny black, with white markings on head, prothorax, mesopleura, tegulae, scutellum, and postscutellum; propodeum with large white spots; first tergite with a white apical fascia which is much broadened on the sides and often continued along the suture toward the middle line; second tergite also with white apical band. Wings black, with violet reflections. Length (h. + th. + t. 1 + 2): ♀, 13 to 15 mm.; ♂, 12 to 14 mm.
A. quadrisectus (Say)

   Propodeum either without horizontal, basal portion, the postscutellum being itself partly comprised in the vertical, posterior face of the thorax; or, if with a short horizontal portion, then the insect much smaller, with bell-shaped first tergite, and different color markings. . 2

2. Body slender, cylindrical. First abdominal tergite lengthened in the middle, convexly swollen, bell-shaped; its hind margin often covering a basal concavity of the second tergite which forms a mite-chamber or acarinarium; the transverse carina curved and often irregular; the posterior area longer in the middle than at the sides, somewhat elliptical in outline. Second sternite with a longitudinal furrow in the middle, before the base (in *A. floridanus* and *A. clypeatus* quite faint). Propodeum, as a rule, with a short, but generally distinct, horizontal portion separating the concavity from the postscutellum (in some species quite narrow). Lower plate of mesepisternum anteriorly with an epicnemial carina. 3

Body not or but little cylindrical, rather stubby; the abdomen and also the thorax more or less depressed. First tergite short and transverse, not bell-shaped; hind margin not covering a mite-chamber; the transverse carina always quite distinct and nearly straight; posterior area more or less rectangular. Base of second tergite with a row of foveae or pit-like punctures. Propodeum without horizontal area behind the postscutellum, the hind portion of which is vertically sloping.....11

3. Interocellar area not flat nor uniformly punctured: the inner margin of posterior ocelli more or less swollen, smooth and shiny; the swellings more distinct in the male than in the female.....4

No interocellar tubercles or swellings, the whole interocellar area flat and uniformly punctured.....8

4. Black, with ferruginous-red markings (some of them occasionally yellowish). Propodeum and first tergite extensively reddish. Wings fusco-violaceous.....5

Black, with lemon-yellow markings; the legs partly ferruginous. Wings generally subhyaline or slightly infuscate, more rarely violaceous.....6

5. Clypeus coarsely punctate, the anterior margin slightly sinuate and with sharp edges in the female, deeply notched in the male. Puncturation dense and coarse on head and thorax, slightly less so on abdomen; that of the first tergite distinctly deeper and denser than of the second; mesopleura and ventral areas of propodeum almost reticulo-punctate. Concavity of propodeum well-defined, its upper edges forming a sharp, crenulate rim which is deeply notched in the middle. Transverse carina of first tergite quite regular, distinct throughout, rim-shaped, followed by a shiny, foveolate groove. Apical margin of second tergite slightly raised, often more so in male. Black, with abundant ferruginous-red markings on head and thorax, the legs entirely of that color; first tergite reddish with a median black spot and black base; second tergite narrowly margined with ferruginous or orange; the apical margin of first tergite sometimes yellow. Clypeus often more or less yellowish in the male. Flagellum partly fulvous. Length (h. + th. + t. 1 + 2): ♀, 11 mm.; ♂, 9 to 9.5 mm....*A. bifurcus* (Robertson)

Clypeus less coarsely punctate, not so deeply notched in male and less bidentate in female. Puncturation of first two abdominal tergites also finer; hind margin of second tergite not reflexed. Black, with clypeus and margin of

second abdominal tergite yellow or orange; spots on thorax, sides of propodeum, legs and entire first tergite (except at extreme base) reddish; free spots on sides of second tergite present or absent. Flagellum of antennae black in male (according to Robertson). Length (h. + th. + t. 1 + 2): ♀, 8 mm. (according to de Saussure).
A. histrio (Lepeletier)

6. Interocellar tubercles narrow, elongate and rather low, continuing in front of the posterior ocelli in the male. Anterior margin of clypeus truncate or at most slightly sinuate in female; clypeus of male distinctly longer than wide, the emargination of the apex rather shallow and broad. Anterior margin of pronotum with a ridge over its entire width, produced and angular at the sides. Puncturation deep and close on head and thorax; quite coarse on the clypeus in the female, less so in the male; that of abdomen moderately coarse and rather sparse; somewhat weaker on the first tergite than on the mesonotum and still less developed on the second tergite. Second sternite with scattered medium-sized punctures, sparser than on the corresponding tergite. A yellow, elongate spot on each side of the first tergite, behind the transverse carina; the second tergite without free lateral spots; in the female a large, lateral, yellow spot on propodeum and generally a small yellow dot on mesonotum before the scutellum (sometimes present in male). Length (h. + th. + t. 1 + 2): ♀, 9 to 10 mm.; ♂, 7.5 to 8 mm.....*A. fulvipes* (Saussure)

Interocellar tubercles broad, merely separated by a narrow line; not lengthened in the male. Second abdominal tergite with a free, yellow spot on each side.....7

7. Clypeus in the female coarsely punctured, with two dentiform edges; in the male strongly punctured, deeply emarginate, with sharp and long apical teeth. Interocellar tubercles of the male strongly bulging. Posterior margin of second tergite coarsely punctured, its apex reflexed and collar-like in both sexes. Length (h. + th. + t. 1 + 2): ♀, 8 mm.; ♂, 7.5 mm.....*A. bicornis* (Robertson)

Clypeus of female less coarsely punctured, its apical margin less angular; of the male feebly punctured and quite shallowly emarginate, with short, sharp edges. Interocellar tubercles of male much less prominent. Posterior margin of second tergite not collar-like. Structural characters as in *A. histrio*. Length (h. + th. + t. 1 + 2): ♂, 6.5 mm. (♀, according to Robertson: 8–10 mm.).
A. histrionalis (Robertson)

8. Female: black, with ferruginous-red and some yellowish markings. Propodeum and first abdominal segment extensively reddish or yellowish-red; a large reddish spot on each side of second tergite. Clypeus with broad, straightly truncate apex and rather fine and sparse puncturation. Transverse carina of first tergite rather distinct, followed by a fluting; the longitudinal furrow at the base of second sternite quite faint. Length (h. + th. + t. 1 + 2): 7 mm. Male unknown.....*A. floridanus* (Robertson)

Black, with lemon-yellow markings; the legs partly ferruginous. Second tergite with a free yellow spot or dot on each side.....9

9. Clypeus squarely truncate at apex in both sexes, somewhat more broadly so in the male, with rounded edges. Hind margin of second tergite not reflexed. Second sternite with very faint longitudinal furrow at base. Middle femora of male more or less flattened on the under side in the basal half and rather abruptly swollen apically. Antennae of the male stubby, extensively ferruginous yellow on the under side over the entire length of flagellum; the apical hook flattened, spoon-shaped. Length (h. + th. + t. 1 + 2): ♀, 6 to 7 mm.; ♂, 5 to 6.5 mm. *A. clypeatus* (Robertson)

Clypeus emarginate at apex with dentiform angles in female, deeply bidentate in male. Hind margin of second tergite more or less reflexed. Second sternite with a deep and sharp longitudinal furrow at base. Middle femora of male normal, gradually and gently swollen. Antennae of male slender, the flagellum black beneath; the apical hook finger-shaped, bluntly pointed at apex.....10

10. Larger, uniformly covered with coarse but rather remote puncturation, somewhat deeper and denser before the apical, raised margin of second tergite; that of clypeus in male very fine and scattered. Body more stubby; the posttegulae quite large and wide in the male. Humeral angles of pronotum blunt. Apical margin of second tergite moderately raised. Both first and second tergites with free, lateral spots, those of the first sometimes connected with the apical fascia; a yellow dot on mesonotum, before the scutellum; propodeum often spotted with yellow in the female. Length (h. + th. + t. 1 + 2): ♀, 8.5 to 11 m.; ♂, 7 to 8.5 mm...*A. saecularis* (Saussure)

Smaller; the puncturation coarse and dense on head; deeper, but more remote on thorax and first tergite; quite fine on second tergite, except before the reflexed apex, where the surface is rugosely reticulate and more or less aciculate

in the male. Body slender; the posttegulae small in the male. Humeral angles of pronotum sharper. No free spots on first tergite and as a rule no dot on mesonotum before scutellum. In the male the apex of the second tergite is strongly reflexed and more or less collar-shaped. Length (h. + th. + t. 1 + 2): ♀, 6.5 to 8.5 mm.; ♂, 5 to 7.5 mm. ..... *A. proximus* (Saussure)

11. Vertex behind the ocelli with a shiny tubercle, which is low in the female, but quite strong in the male. Hind margin of second tergite reflexed, more or less collar-shaped. Second sternite with a median, longitudinal furrow at base 12

Vertex not tuberculate behind the ocelli 13

12. Abundantly marked with ferruginous-red, the abdomen extensively of that color. Pronotum, hind portions of tergites and clypeus more or less yellow (especially in the male). Wings with violaceous tinge. Tubercle of vertex large and prominent, occupying nearly the whole width between the posterior ocelli in male. Reflexed collar of second tergite quite high, preceded by a deep and extremely rugose channel, some of the punctures being separated by spinulose ridges. Length (h. + th. + t. 1 + 2): ♀, 11 to 12.5 mm.; ♂, 8.5 to 9.5 mm.
A. tuberculocephalus (Saussure)

Extensively lemon-yellow, the antennae and legs partly reddish. Wings with yellowish tinge. Tubercle of vertex rather small, occupying but little over one-third of the distance between the posterior ocelli in male. Reflexed collar of second tergite rather low, the channel less spinulosely rugose. Length (h. + th. + t. 1 + 2): ♀, 10.5 to 11.5 mm.; ♂, 7 to 8 mm.
A. sutterianus Saussure

13. Second sternite with a deep, median, longitudinal furrow at base. Lateral angles of propodeum rounded off; at most the superior ridge present 14

Second sternite not furrowed longitudinally. Propodeum with prominent lateral angles and a carinate margin around the concavity 15

14. Second tergite with moderately deep and dense punctures, uniformly scattered over the segment, somewhat deeper and rougher posteriorly. Concavity of propodeum without superior ridge, its edges completely rounded off. Thorax rather stubby, broadly truncate anteriorly, somewhat flattened above. First abdominal segment short and stubby. Third cubital cell long, about as long

on the radial cell as high at base. Yellow markings more abundant; clypeus of female, tegulae and scutellum usually spotted, and the second and third tergites with apical fasciae. Wings moderately infuscate, but slightly violaceous. Length (h. + th. + t.1 + 2): ♀, 10 to 11 mm.; ♂, 7.5 to 8 mm. ..... *A. campestris* (Saussure)

Second tergite quite finely and remotely punctate over most of the surface, roughly and coarsely before the apical margin, where it is generally depressed and more or less deeply channeled. Concavity of propodeum bordered by a slight carina above. Thorax more elongate and rounded off anteriorly, convex above. First abdominal segment more elongate. Third cubital cell short, higher than long at the radial cell. Yellow markings usually less abundant, often absent on tegulae, scutellum and apical margins of second and third tergites. Wings strongly infuscate and quite violaceous. Length (h. + th. + t. 1 + 2): ♀, 9 to 12.5 mm.; ♂, 7.5 to 8.5 mm.
A. unifasciatus (Saussure)

15. Black, with white or creamy-white markings. Ventral areas and concavity of propodeum dull. Second sternite, viewed in profile, gently swollen and rounded off before the base. Hook-shaped segment of male antennae pointed, reaching the apex of the tenth 16

Black with lemon-yellow or orange-yellow markings 17

16. Body quite stubby; the thorax short and broad, seen from above hardly longer than wide. First abdominal tergite short and wide; more than twice as wide at the transverse ridge than the postsutural area is long in the middle. Puncturation of abdomen rather fine and sparse; the clypeus of the male almost impunctate. Lateral angles of propodeum prominent, though blunt, separated from the superior ridge by a depression. Ventral areas and concavity of propodeum rather finely sculptured. Clypeus of female with truncate or sinuate apical margin and distinct, sharp edges; of male deeply emarginate, the incision about as deep as the distance between the apices of the two sharp, triangular teeth. White markings rather extensive: female as a rule with four spots on the clypeus, two on the postscutellum and one before the tip of the last tergite. Length (h. + th. + t. 1 + 2): ♀, 9.5 to 12 mm.; ♂, 8 to 9.5 mm. . . *A. waldenii* (Viereck)

Body elongate, slender; the thorax seen from above distinctly longer than wide. First abdominal tergite relatively narrow, about twice as wide at the transverse ridge as the

length of the postsutural area in the middle. Punctuation of the abdomen more abundant and of medium coarseness; the clypeus of the male distinctly punctured. Lateral angles of propodeum quite low, not separated by a depression from the superior ridge. Ventral areas and concavity of propodeum more rugosely sculptured. Apical margin of clypeus in female with blunt edges. Clypeus of male semi-circularly, more shallowly emarginate at apex. Female generally with but two whitish spots on the clypeus, and none on the postscutellum and apical tergite. Length (h. + th. + t. 1 + 2): ♀, 9 to 10.5 mm.; ♂, 5 to 8 mm...*A. albophaleratus* (Saussure)

17. Body quite stubby; the thorax short and broad, seen from above not longer than wide. First abdominal tergite quite wide and short. Second sternite slightly convex near the base. Lateral angles of propodeum prominent, blunt, preceded by a slight lowering of the superior ridge; the ridge ending in a projecting upper edge separated by a notch from the postscutellum. Ventral areas below and concavity of propodeum finely shagreened and slightly shiny; the upper portion of the ventral areas rugosely punctate, almost reticulate. Clypeus very finely and sparsely punctate; that of female much broader than long, the apex truncate with the edges broadly rounded off; that of male semi-circularly emarginate, with sharp teeth. Hook-shaped segment of male antennae blunt, reaching the apex of the tenth. Yellow markings quite abundant; clypeus of female entirely yellow, and the apical tergite in that sex with a yellow spot; second tergite generally with a free yellow spot on each side (more often absent in the male than in the female). Length (h. + th. + t. 1 + 2): ♀, 10 to 12 mm.; ♂, 7.5 to 10.5 mm.
A. birenimaculatus (Saussure)

Body more elongate; the thorax longer than broad. Clypeus of female at most as wide as long. Second tergite without free, yellow spot.....18

18. Lower portion of ventral areas and concavity of propodeum smooth and shiny, not shagreened and almost impunctate. Large species, with very elongate thorax; the hind part of mesonotum and scutellum flattened; parapsidal furrows conspicuously developed. Second sternite, viewed sideways, convexly rounded off before the ribbed base. Hook-shaped segment of male antennae quite thick and short, not longer than the preceding and not reaching over half the length of the eleventh.....19

Ventral areas and concavity of propodeum dull, either finely shagreened, or roughly punctate or striate.....20

19. Pale markings of body and legs lemon-yellow; the apical fasciae of the abdominal segments narrow, often reduced or absent on the last segments; the sixth tergite of the female black. Puncturation of the abdomen quite fine and scattered, the second tergite almost impunctate anteriorly and generally quite shiny; the thin, black bloom being usually rubbed off; the longer pilosity very sparse and gray. Wings nearly hyaline, faintly cloudy with violaceous tinge along the anterior margin. Length (h. + th. + t. 1 + 2): ♀, 11.5 to 13 mm.; ♂, 7.5 to 9.5 mm. ..... *A. capra* (Saussure)

    Pale markings of body and legs orange-yellow; the apical fasciae of the abdominal segments quite broad and present on all; the sixth tergite of the female with an orange-yellow spot. Puncturation of the abdomen more abundant, the hind margin of the second tergite especially with rough and dense punctures. The second tergite not shiny, being covered with a dense, dull, black, velvety bloom. Longer pilosity somewhat yellowish on the hind half of the abdomen. Wings slightly and more generally infuscate, violaceous near the anterior margin, yellowish toward the base. Length (h. + th. + t. 1 + 2): ♀, 12.5 to 14 mm.; ♂, 9.5 to 11 mm. . . . *A. navajo* J. Bequaert

20. Large, shiny species, with very elongate thorax; the hind part of mesonotum and scutellum flattened; the parapsidal furrows long and conspicuously developed. Ventral areas and concavity of propodeum finely shagreened, almost without rough sculpture. Abdomen with fine and quite scattered puncturation, the basal portion of the second tergite almost impunctate. Second sternite, viewed sideways, slightly convex at base in the middle. Antennal hook of male short and stubby, not reaching over half the length of the eleventh segment. Wings often quite infuscate and violaceous in female. Length (h. + th. + t. 1 + 2): ♀, 12 to 13.5 mm.; ♂, 9 mm.
A. spinolae (Saussure)

    Smaller, rather dull species, with shorter thorax; parapsidal furrows not reaching beyond the middle of the mesonotum. Ventral areas and concavity of propodeum more roughly sculptured. Antennal hook of male long, reaching to near the base of the eleventh segment. Wings subhyaline or faintly violaceous near anterior margin. 21

21. Second abdominal sternite, viewed sideways, uniformly flattened toward the base, without convexity, rather somewhat depressed in the middle near the basal row of acicular. Yellow body markings quite abundant; the apical

fascia of the first tergite conspicuously widened on the sides; the sixth tergite of the female usually with a yellow spot. Length (h. + th. + t. 1 + 2): ♀, 9 to 10 mm.; ♂, 6 to 7.5 mm.....*A. parietum* (Linnaeus)

Second abdominal sternite, viewed sideways, convexly swollen toward the base, where it is quite gently rounded off near the basal row of aciculae. Yellow markings as a rule less extended.....22

22. Smaller, more slender. Second abdominal segment elongate, about as long as its greatest width, and but little wider than the first. First tergite longer, the postsutural area about twice as wide as long in the middle. Thorax narrower, more flattened above, especially on the scutellum, and with more distinct traces of parapsidal furrows in the posterior part of the mesonotum; also more shiny above; the lateral angles of propodeum moderately pronounced. Antennae of the female shorter and more swollen toward apex; of the male also shorter and more stubby, the scape shorter and the flagellum more or less beaded; the scape of male not longer than the following two segments together. Length (h. + th. + t. 1 + 2): ♀, 7 to 9 mm.; ♂, 5 to 7.5 mm.....*A. tigris* (Saussure)

Larger, more stubby. Second abdominal segment shorter, wider than long and distinctly broader than the first. First tergite shorter, the postsutural area more than twice as wide as long in the middle. Thorax broader, more convex above; the scutellum not appreciably flattened; the mesonotum with mere traces of parapsidal furrows behind; dull; lateral angles of propodeum quite prominent, separated from the superior ridge by a sinuosity. Antennae more slender in both sexes, not markedly beaded in the male; the scape of male distinctly longer than the following two segments together. Length (h. + th. + t. 1 + 2): ♀, 8 to 10.5 mm.; ♂, 6 to 8 mm.
A. catskillensis (Saussure)

Subgenus **Pseudodynerus** H. de Saussure

1. **Ancistrocerus quadrisectus** (Say)

Odynerus quadrisectus Say, Boston Journ. Nat. Hist., I, 4, 1837, p. 385 (♀ ♂). (United States, without more definite locality.)

Odynerus (*Ancistrocerus*) *quadrisectus* H. de Saussure, Et. Fam. Vesp., III, 1856, p. 206 (not the variety nor the figure).

Ancistrocerus quadrisectus H. de Saussure, Synopsis of American Wasps, 1875, p. 193 (♀ ♂).

Odynerus bellone Lepeletier de St. Fargeau, Hist. Nat. Ins. Hym., II, 1841, p. 660 (♀ ♂). (Type locality: Carolina.)

Odynerus (*Ancistrocerus*) *bellone* H. de Saussure, Et. Fam. Vesp., I, 1852, p. 146 (♀ ♂).

I have seen specimens from the following localities: NEW JERSEY: Englewood, September 12, 1920, 1 ♀ (J. Bequaert). PENNSYLVANIA: Rockville (N. Banks). MARYLAND: Great Falls (N. Banks). VIRGINIA: Glencarlyn and Falls Church (N. Banks); Jones Creek, Lee Co. GEORGIA: Okefenokee Swamp (J. C. Bradley). FLORIDA: Gulfport (Reynolds); Lakeland and Everglade (W. T. Davis); Palatka (J. C. Bradley). OHIO: Sugar Grove, Ross Co.; Lancaster, Fairfield Co.; West Jefferson, Franklin Co. (J. Bequaert). KANSAS: Wathena. KENTUCKY: (Sanborn); Cumberland Gap (G. Dimmock). TEXAS: Dallas (Boll); Fedor, Lee Co. (Birkmann). LOUISIANA: Morgan City and Shriever (J. Bequaert). It has also been recorded from Carolina and Tennessee by de Saussure and from Missouri by P. Rau. I know of no record from New York State or New England.

The species is quite easily recognized and the largest *Ancistrocerus* of the North American fauna. It may be well to point out that the "two tubercles of brown hair" mentioned by de Saussure are not tubercles at all, but merely dense patches of long, brownish pile placed on a flattened, smooth and shiny, transverse area of the vertex in the female. No trace of them is to be seen in the male.

The most northerly locality known to me is Englewood, New Jersey (opposite New York City), where this wasp was found nesting in galleries burrowed in the wood of a dead tree. Ashmead[26] says that he bred from it the parasite *Chrysis densa* Cresson, in Florida.

The types are no longer in existence.

As de Saussure has pointed out[27] the variety from Santa Marta, Colombia, described and figured in 1856, is a different wasp. He apparently referred it to a "*Monobia maxillaris*," which, according to Zavattari, is identical with *Odynerus anisitsii* Brèthes (1906). A study of a female from Bolivia confirms Zavattari's opinion. I believe, however, that the name *maxillaris*, which was based in 1874 upon a published description and figure, is valid and should replace *anisitsii*. The species is a true *Ancistrocerus* of the subgenus *Pseudodynerus*.

[26] Psyche, VII, 1894, p. 79.

[27] Syn. Amer. Wasps, 1875, p. 193, footnote.

Subgenus **Parancistrocerus** J. Bequaert

2. **Ancistrocerus bifurcus** (Robertson)

Odynerus (*Stenancistrocerus*) *bifurcus* Robertson, Trans. Amer. Ent. Soc., XXVII, 1901, pp. 196 (♂), 197 (♀), and 198 (♀ ♂). (Type locality: Inverness, Florida.)

I refer to this species specimens from FLORIDA: Everglade and Marco (W. T. Davis); Punta Rassa and Coronado Beach (J. C. Bradley); Daytona and St. Augustine (C. W. Johnson); Fort Worth.

The type and allotype are in Robertson's collection.

3. **Ancistrocerus histrio** (Lepeletier de St. Fargeau)

Odynerus histrio Lepeletier de St. Fargeau, Hist. Nat. Ins. Hym., II, 1841, p. 638 (♂). (Type locality: Carolina.) H. de Saussure, Et. Fam. Vesp., III, 1856, p. 242.

Odynerus (*Leionotus*) *histrio* H. de Saussure, Et. Fam. Vesp., I, 1852, p. 208 (♀).

Ancistrocerus (*Stenancistrocerus*) *histrio* H. de Saussure, Synopsis of American Wasps, 1875, p. 199 (♀ ♂) (in part only!).

Odynerus (*Stenancistrocerus*) *histrio* Robertson, Trans. Amer. Ent. Soc., XXVII, 1901, pp. 196 (♂) and 197 (♀).

Eumenes paccata "Bosc" Lepeletier de St. Fargeau, Hist. Nat. Ins. Hym., II, 1841, p. 639 (as a synonym of *histrio*).

I have not seen specimens that are undoubtedly *histrio* as originally described by Lepeletier (without free, lateral spots on the second tergite). *O. histrio* of de Saussure, 1852, is said to be based upon Lepeletier's type; but in 1875 he appears to have included several other forms, some of which were perhaps structurally different. It is unfortunate that Robertson did not state his reasons for restricting *histrio* to a form with swellings along the hind ocelli and a moderately punctured clypeus. Whether he was correct can only be decided after examining Lepeletier's type which should be at the Paris Museum.

A female from Upper Metacombe Key, Florida (Brooks), I regard as *histrio*, following Robertson's interpretation. It possesses, however, free, lateral, orange yellow spots on the second tergite. It measures (h. + th. + t. 1 + 2) 7.5 mm.

Another female from Ft. Myers, Florida (J. C. Bradley), is quite small (h. + th. + t. 1 + 2: 6 mm.) and the inner margins of the posterior ocelli are just barely swollen. The clypeus is mostly reddish; the propodeum black with the extreme angles somewhat reddish; the first segment ferruginous-red with a narrow, yellowish hind margin; the second tergite black, with broad, orange-yellow apical band, and without free spots; possibly it represents a distinct, though allied, species.

4. **Ancistrocerus fulvipes** (Saussure)

Odynerus flavipes Lepeletier de St. Fargeau, Hist. Nat. Ins. Hym., II, 1841, p. 659 (♂). [Not of Fabricius.] (Carolina.)

Odynerus (*Ancistrocerus*) *flavipes* H. de Saussure, Et. Fam. Vesp., I, 1852, p. 142 (♀ ♂), pl. XVI, figs. 3 and 3*a* (♀). [Not of Fabricius.]

Odynerus (*Ancistrocerus*) *fulvipes* H. de Saussure, Et. Fam. Vesp., III, 1856, p. 205 (♀ ♂). (Type locality: Carolina.)

Ancistrocerus (*Stenancistrocerus*) *fulvipes* H. de Saussure, Synopsis of American Wasps, 1875, p. 201 (♀ ♂).

Odynerus (*Stenancistrocerus*) *fulvipes* Robertson, Trans. Amer. Ent. Soc., XXVII, 1901, pp. 196 (♂) and 197 (♀).

I have seen this species from the following localities: NEW JERSEY: Trenton (Abbott). VIRGINIA: Petersburg (J. Bequaert). NORTH CAROLINA: Concord (J. Bequaert). GEORGIA: MacCollum, Coweta Co. (J. Bequaert). KANSAS: Baldwin (J. C. Bridwell). LOUISIANA: Bogalusa (J. Bequaert). TEXAS: Wharton, Victoria, and Dayton (J. Bequaert); Fedor, Lee Co. (Birkmann); Dallas (Boll). WEST VIRGINIA: Monongalia Co. (L. H. Taylor).

Lepeletier's type (♂) and de Saussure's allotype (♀) of *flavipes*, on which *A. fulvipes* were originally based, are probably at the Paris Museum.

Mr. and Mrs. P. and N. Rau[28] have studied near St. Louis, Missouri, the habits of a wasp which was referred by Rohwer to *A. fulvipes*. It builds its cells in linear succession within burrows in wood or clay banks, the gallery being often dug by the wasp. The prey consists of small caterpillars which appear to be hardly paralyzed, if stung at all, as they are still able to pupate within the cell. Sometimes *A. fulvipes* makes good use of the old cells of mud-daubers (*Sceliphron caementarium*).[29] B. D. Walsh and

[28] Wasp Studies Afield, 1918, pp. 340–344.

[29] P. and N. Rau, Journ. Anim. Behavior, VI, 1916, p. 43.

C. V. Riley[30] have figured a nest built in a spool, from which they obtained an undetermined species of *Odynerus*. In the same paper they record observations on a "much larger species," doubtfully referred to "*Odynerus flavipes*? Fabr.," which had established a cell "in a hole in the top of a common black wooden ink-stand" in a room. Walsh and Riley's figures have been repeatedly copied (by J. B. Smith, L. O. Howard, and others) and attributed by error to *A. fulvipes*.

5. **Ancistrocerus bicornis** (Robertson)

Odynerus (*Stenancistrocerus*) *bicornis* Robertson, Trans. Amer. Ent. Soc., XXVII, 1901, pp. 196 (♂), 197 (♀), and 198 (♀ ♂). (Type locality: Inverness, Florida.)

Ancistrocerus (*Stenancistrocerus*) *ceanothi* Rohwer, Proc. U. S. Nat. Mus., XLI, 1912, p. 449 (♀ ♂). (Type locality: Glencarlyn, Virginia.)

Specimens examined: FLORIDA: Inverness (cotype ♂; Robertson). ALABAMA: Thomasville, Clarke Co. (♂; J. Bequaert). VIRGINIA: Falls Church (♀) and Glencarlyn (♂) (paratypes of *ceanothi;* N. Banks).

I was able to compare one of Robertson's "cotypes" (♂), at the Academy of Natural Sciences, Philadelphia, with a paratype (♂) of *ceanothi* in Mr. Nathan Banks' collection, now at the Museum of Comparative Zoölogy, and I fail to discover appreciable differences. The interocellar tubercles are unusually developed in this species, conspicuously shiny and bulging, and quite wide. In all specimens I have seen, both the first and second tergites bear lateral free spots; the spot on the mesonotum, before the scutellum, may be present or absent. The clypeus of the male is either entirely yellow or with the lower margin black, sometimes also with a black, median spot.

Type and allotype of *bicornis* are in Robertson's collection; those of *ceanothi* are at the United States National Museum.

6. **Ancistrocerus histrionalis** (Robertson)

Odynerus (*Stenancistrocerus*) *histrionalis* Robertson, Trans. Amer. Ent. Soc. XXVII, 1901, pp. 196 (♂), 197 (♀) and 199 (♀ ♂). (Type locality, by present selection: Carlinville, Illinois.)

Specimens examined: ILLINOIS: Carlinville (cotype ♂; Robertson). NEW JERSEY: West Englewood (♂; J. Bequaert). Robertson also saw the male from Inverness, Florida.

[30] Amer. Entom., II, 1869, p. 10.

The interocellar tubercles are short, wide, and rather low in this species. In the male it is easily separated from *fulvipes* by the shape of the clypeus, which is more elongate, with the free apical portion longer than the basal, fixed part.

Type and allotype in Robertson's collection. I have seen a ♂ "cotype" at the Academy of Natural Sciences, Philadelphia.

7. **Ancistrocerus floridanus** (Robertson)

Odynerus (*Stenancistrocerus*) *floridanus* Robertson, Trans. Amer. Ent. Soc., XXVII, 1901, pp. 197 and 200 (♀). (Type locality: Inverness, Florida.)

FLORIDA: Punta Rassa, 1 ♀ (J. C. Bradley).

I refer to the same species a female from Tybee Island, Georgia (J. C. Bradley), which agrees structurally with the female from Punta Rassa, but the color markings are more yellowish; they are, however, much more abundant than in *A. clypeatus*. It is probable that Robertson was right in his surmise that *floridanus* should be regarded as a variety of *clypeatus;* I have been unable to discover structural differences between the females of these two forms. It remains to be seen whether the undiscovered male possesses the characteristic structure of the middle femora, clypeus, and antennae of *clypeatus*.

Type in Robertson's collection. A cotype, received from Robertson, is at the Academy of Natural Sciences, Philadelphia.

8. **Ancistrocerus clypeatus** (Robertson)

Odynerus (*Stenancistrocerus*) *clypeatus* Robertson, Trans. Amer. Ent. Soc., XXVII, 1901, pp. 196 (♂), 197 (♀), and 199 (♀ ♂). (Type locality: Carlinville, Illinois.)

I have seen this species from the following localities: MASSACHUSETTS: Wellesley (♂; A. P. Morse); Pocasset, Bassett's Island, and Cohasset (C. W. Johnson); Cambridge; Provincetown. RHODE ISLAND: Buttonwoods (C. W. Johnson). NEW YORK: Long Pond, Wading River, Long Island (W. T. Davis). NEW JERSEY: Ramsey (several ♀ and ♂; J. Bequaert). OHIO: Lancaster, Fairfield Co. (J. Bequaert). VIRGINIA: Petersburg (♂; J. Bequaert). MISSISSIPPI: Biloxi, 1 ♂ (J. Bequaert). LOUISIANA: Shriever, Terrebonne Parish, 1 ♀ (J. Bequaert).

The northern specimens agree quite well in coloration with Robertson's description; the propodeum is entirely black. The Louisiana and Mississippi specimens are similar in structure and

sculpture, but the propodeum has yellow lateral spots, the first tergite has lateral spots extending forward from the apical band, and the legs are almost entirely reddish yellow.

A. clypeatus agrees with *floridanus* in having but a faint longitudinal furrow at the base of the second sternite. Neither of them appears to posses an acarid chamber at the base of the second tergite.

Type and allotype in Robertson's collection. I have also seen "cotypes," sent by the author, at the Academy of Natural Sciences, Philadelphia.

9. **Ancistrocerus saecularis** (H. de Saussure)

Odynerus (*Ancistrocerus*) *saecularis* H. de Saussure, Et. Fam. Vesp., I, 1852, p. 142 (no sex). (Type locality: Carolina.)

Ancistrocerus (*Stenancistrocerus*) *saecularis* H. de Saussure, Synopsis of American Wasps, 1875, p. 202 (♀ ♂).

Odynerus (*Stenancistrocerus*) *saecularis* Robertson, Trans. Amer. Ent. Soc., XXVII, 1901, pp. 196 (♂) and 197 (♀).

Stenancistrocerus saecularis P. Rau, Ent. News, XXXIV, 1923, p. 243 (habits).

KANSAS: Wathena. VIRGINIA: Cochran, Brunswick Co. (J. Bequaert); Falls Church (N. Banks); Virginia Beach (A. P. Morse); Vienna. MARYLAND: Plummer's Island (J. Bequaert). ALABAMA: Auburn, at flowers of *Asclepias tuberosa*, and Mobile (J. Bequaert). LOUISIANA: Darrow, Ascension Parish (J. Bequaert). TEXAS: Fedor, Lee Co. (Birkmann).

The type specimen, which is probably still at the Paris Museum, lacked the antennae, clypeus, and last abdominal segments, so that the sex could not be defined. H. de Saussure does not appear to have had it before him when drawing up his more extended description of 1875, since he mentions no other definite locality than Tennessee. The species, as here recognized, agrees with Robertson's interpretation. It then agrees with de Saussure's original description in having both the first and second tergites marked with lateral, yellow spots, in addition to the apical fasciae; on the first tergite the spots are transverse "forming a line interrupted in the middle," and often too they are separated from the margin; there is also a yellow dot on the mesonotum, just before the scutellum.

The habits of this species have been studied near St. Louis, Missouri, by Mr. and Mrs. P. and N. Rau.[31] It burrows a

[31] Wasp Studies Afield, 1918, pp. 332–334, where it is erroneously referred to *Stenodynerus pedestris;* see Ent. News, XXXIV, 1923, p. 243.

gallery in clay banks, and, from time to time, constructs chambers beneath it, as they are needed; when the cell is provisioned with caterpillars, the short neck which connects it with the main gallery is tightly packed with soil.

10. **Ancistrocerus proximus** (H. de Saussure)

Odynerus (*Ancistrocerus*) *proximus* H. de Saussure, Rev. Mag. Zool., (2), IX, 1857, p. 274 (♂). (Type locality: New York.)

I have seen a number of specimens agreeing quite well with de Saussure's brief original description, which may here be translated: "Black; the entire body much punctured, adorned with yellow; abdomen strongly punctured; segments 1 and 2 margined with yellow, the others with incomplete or without fasciae; the second segment has its margin reflexed and its base adorned on each side with a yellow dot; clypeus of male yellow, with its lower part black." The species was originally described as an *Ancistrocerus* of the group of *A. fulvipes;* but in 1875,[22] de Saussure made it a synonym of *Odynerus pedestris* Saussure. It is indeed similar to that species, but possesses an irregular carina on the first tergite often quite as distinct as in *A. saecularis.* It differs, in addition, in the humeral angles of the pronotum being more pronounced than in *pedestris;* in the male the lower margin and teeth of the clypeus and the under side of the flagellum are black or but faintly ferruginous; whereas in *pedestris* the whole clypeus is yellow and the flagellum is extensively ferruginous yellow on the under side. Yet, *proximus* is certainly on the border line of *Parancistrocerus* and *Stenodynerus* and it will not always be easy to distinguish it from *pedestris.*

I refer to *proximus* male specimens from the following localities: MASSACHUSETTS: Forest Hills and Blue Hills Reservation (J. Bequaert); Wellesley (A. P. Morse); Dedham. NEW YORK: Springs, Long Island; Gardiner's Island; Central Park, Long Island; Orient, Long Island; West Nyack (J. Bequaert); Long Island (Yaphank and Wading River); Staten Island (W. T. Davis); Fort Montgomery (F. M. Schott). NEW JERSEY: Alpine; Ramsey; Great Piece Meadow; Palisades; Millburn; Lahaway, Ocean Co.; Greenwood Lake (all collected by J. Bequaert). OHIO: Lancaster, Fairfield Co. (J. Bequaert). VIRGINIA: Peters-

[22] Syn. Amer. Wasps, p. 323.

burg (J. Bequaert). I have seen what is apparently the female from Ramsey, New Jersey, and Orient, Long Island, New York.

The male is most easily recognized. It is black with the following yellow markings: clypeus, except for the lower margin and the apical teeth; under side of scape; a dot above insertion of antennae; a spot filling the bottom and lower margin of the sinus of the eye; an elongate spot behind the eye above; a wide pronotal band anteriorly, interrupted in the middle; a small dot on mesopleura, below base of wing; posttegulae; postscutellum; apical fasciae on tergites one to six, often absent or faint on the third, fifth and sixth; also on sternites two and three; a dot on the sides of tergite two, usually minute, sometimes rather large. Tegulae, knees, tibiae, and tarsi more or less ferruginous yellow. I have seen no males with a dot on the mesonotum before the scutellum; but in some from Forest Hills, Massachusetts; Millburn, Lahaway, and Ramsey, New Jersey, and Orient, New York, the yellow dot is entirely lacking on the sides of the second tergite; otherwise these specimens are exactly like the others and there can be no doubt that they are conspecific.

The female is colored exactly like that of *Odynerus pedestris* and quite hard to separate from that species, as the transverse carina of the first tergite is not always well marked. Of the three specimens which I regard as such, two have a minute dot on each side of tergite two, but no dot on the mesonotum, and the other has dots on tergite two and in addition a dot on the mesonotum. There are also females from Fort Lee, New Jersey, and West Nyack and Orient, New York, which probably are *proximus*, but lack the dots on the second tergite.

The type (or types) are probably in de Saussure's collection at the Natural History Museum of Geneva.

Subgenus **Ancistrocerus**, proper

11. **Ancistrocerus tuberculocephalus** (H. de Saussure)

Odynerus (*Ancistrocerus*) *tuberculocephalus* H. de Saussure, Et. Fam. Vesp., I, 1852, p. 139 (♀ ♂), pl. XVI, fig. 9 (♀). (Type locality: Mexico.)

Odynerus (*Ancistrocerus*) *tuberculiceps* H. de Saussure, op. cit., I, 1852, p. 6 of introduction (errata; later emendation); III, 1856, p. 205.

Ancistrocerus tuberculiceps H. de Saussure, Synopsis of American Wasps, 1875, p. 184 (♀ ♂).

I have seen specimens from the following localities: Colorado: Manitou; Boulder (S. A. Rohwer); Ft. Reynolds (Miller). New Mexico: Jemez Springs (John Woodgate). Arizona: Ft. Grant, Pinaleño Mts. (J. C. Bradley); Ft. Defiance (Alex. Black); Huachuca Mts. (C. Schaeffer); Palmerlee; Mt. Lemon, Santa Catalina Mts., 7,800 ft. (J. Bequaert); Southern Arizona (F. H. Snow); According to de Saussure it is a common species in Mexico.

The mesonotum of the female generally bears two reddish lines, which are absent in the male; they are also lacking in a female from Ft. Defiance.

Care should be taken not to confuse this with another species of *Ancistrocerus* found in New Mexico, Arizona, and Colorado, and which is colored almost exactly like it. It lacks, however, the tubercles of the vertex in both sexes and the sides of the second sternite are much more swollen and abruptly sloping at the base. I have not yet recognized it among the described species, but it is evidently allied to *A. unifasciatus*.

The type and allotype of *tuberculocephalus*, of de Romand's collection, are possibly at the Paris Museum.

12. **Ancistrocerus sutterianus** H. de Saussure

Ancistrocerus sutterianus H. de Saussure, Synopsis of American Wasps, 1875, p. 186 (♀ ♂). (Type locality: California.)

This is specifically quite distinct from *A. tuberculocephalus*. In addition to the characters mentioned in the key, the thorax is much more stubby and broadly truncate anteriorly, the pronotum forming blunt, lateral angles in the female and salient, sharp edges in the male.

Specimens examined: California: Stanford University (W. M. Mann); Palo Alto (Academy of Natural Sciences, Philadelphia); Watsons, Sonoma Co. Oregon: Corvallis; Springfield. Idaho: Warren, Idaho Co. Utah: Stockton (T. Spalding).

Type and allotype probably in de Saussure's collection at the Natural History Museum of Geneva.

13. **Ancistrocerus campestris** (H. de Saussure)

Odynerus (*Ancistrocerus*) *campestris* H. de Saussure, Et. Fam. Vesp., I, 1852, p. 137 (♀). (Type locality: Carolina.) Ibid., III, 1856, p. 204 (♂). (Type locality of ♂: Florida.)

Ancistrocerus campestris H. de Saussure, Synopsis of American Wasps, 1875, p. 183 (♀ ♂).

Specimens examined: Massachusetts: Cambridge. Connecticut: Stamford (E. J. Smith). New York: Ithaca (E. J. Smith); Staten Island (W. T. Davis). New Jersey: Palisades (G. P. Engelhardt); Lahaway, Ocean Co., and West Englewood (J. Bequaert). Pennsylvania: (Melsheimer). Illinois: Algonquin. Ohio: Lancaster, Fairfield Co.; West Jefferson, Franklin Co.; and Sugar Grove (J. Bequaert). Kentucky: (Sanborn). Maryland: Plummer's Island (J. Bequaert). Georgia: Roswell (King). Delaware. Virginia: Falls Church (N. Banks). Texas: Fedor, Lee Co. (Birkmann); Dallas (Boll).

Generally the first and second tergites have a broad, and the third a narrow, apical fascia; that of the first being abruptly widened on the sides.

Recently I have seen a male from Chicago, Illinois (C. T. Brues), with a small, free, yellow spot on each side of the second tergite. To the characters given in the key should be added that, in the male, the second tergite is, as a rule, channeled and roughly aciculate before the apex.

The type (♀) of the Guérin-Méneville collection is possibly at the Paris Museum; the allotype (♂) at the British Museum.

Mr. and Mrs. P. and N. Rau[33] mention having found this species nesting in discarded mud nests of *Sceliphron caementarium*, near St. Louis, Missouri.

I have seen male and female of an *Ancistrocerus* from Washington State, evidently allied to *campestris*. It differs in the structure of the propodeum which has a faint indication of an upper ridge (though not by any means as distinct as in *unifasciatus*), and in the puncturation of the abdomen, which is much finer and more remote (though more pronounced than in *unifasciatus*). The clypeus of the male is longer and almost smooth. In coloration it is very different, having lateral yellow spots on tergites one and two and on sternite two in the female, those of the second tergite connected with the apical fascia. In the male these spots may be present or absent.

14. **Ancistrocerus unifasciatus** (H. de Saussure)

Odynerus uncinatus Say, Boston Journ. Nat. Hist., I, 4, 1837, p. 386 (♀) (not *Vespa uncinata* Fabricius). Described from Indiana.

Odynerus (*Ancistrocerus*) *unifasciatus* H. de Saussure, Et. Fam. Vesp., I, 1852, p. 138 (♀). (Type locality: Carolina.) Ibid., III, 1856, p. 205.

[33] Journ. Anim. Behavior, VI, 1916, p. 43, and Trans. Ac. Sci. St. Louis, XXIV, 7, 1922, p. 15.

Ancistrocerus unifasciatus H. de Saussure, Synopsis of American Wasps, 1875, p. 181 (♀ ♂).

Specimens examined: New Hampshire: Squam Lake (C. H. Page); Holderness (A. P. Morse); Hanover (C. W. Johnson); White Mountains. Massachusetts: Great Barrington (G. P. Engelhardt); Lexington and Forest Hills (J. Bequaert); Sherborn (E. J. Smith); Wellesley and New Braintree (A. P. Morse); Rutland; Southbridge; Wellfleet; Sharon; Woods Hole; Worcester; and Sandwich (C. W. Johnson); Wollaston (Sprague); Cambridge (A. E. Verrill). Connecticut: New Haven (M. P. Zappe). Vermont: Chittenden (J. Bequaert). New York: Roslyn and Sea Cliff, Long Island (N. Banks); Ithaca (J. C. Bradley); Keene Valley (H. Notman); Orient and Cold Spring Harbor, Long Island, and Mt. Marcy, 4,800 ft. (J. Bequaert); Nyack; Eltingville, Staten Island (W. T. Davis). New Jersey: Englewood (J. Bequaert). Pennsylvania: Broad Top Mtn. (Leidy). Illinois: Algonquin. Maryland: Beltsville (N. Banks). Virginia: Great Falls and Falls Church (N. Banks). North Carolina: N. Fork Swannanoa, Black Mts. (N. Banks). Georgia: Tallulah Falls (J. C. Bradley); Roswell (King). Texas: Fedor, Lee Co. (Birkmann). H. de Saussure records it from Iowa, Tennessee, and Florida.

The coloration is rather variable in this species: most of the northern specimens have but few yellow markings on the thorax and the second tergite is entirely black in the female. Southern examples are more richly ornamented and frequently are more or less reddish on the sides of the first tergite or even along the inner margin of the yellow, apical fascia of the second tergite. The reddening of the first tergite is occasionally observed in northern males.

The type (♀) should be at the Paris Museum, the allotype (♂) in de Saussure's collection at the Natural History Museum of Geneva.

I have taken the male at flowers of *Aralia hispida* in Vermont. Mr. and Mrs. P. and N. Rau[34] bred two specimens from an old nest of a mud-dauber (*Sceliphron caementarium*) at St. Louis, Missouri.

[34] Ent. News, xxiv, 1913, pp. 396–397.

15. **Ancistrocerus spinolae** (H. de Saussure)

Odynerus (*Ancistrocerus*) *spinolae* H. de Saussure, Et. Fam. Vesp., III, 1856, p. 216 (no sex). (Type locality: Philadelphia.)

Ancistrocerus spinolae H. de Saussure, Synopsis of American Wasps, 1875, p. 165(♀).

Specimens examined: NEW YORK: Long Beach, Long Island, 1 ♂ (J. Bequaert); Yaphank, Long Island, 1 ♀ (W. T. Davis). PENNSYLVANIA: Broad Top Mtn. (Leidy). OHIO: Put-in-Bay, 1 ♀; London, 1 ♀. KENTUCKY: (1 ♀; Sanborn). VIRGINIA. GEORGIA. TEXAS: Fedor, Lee Co. (1 ♀; Birkmann).

H. de Saussure records it from Connecticut, Indiana, Illinois, and Tennessee. Although having such a wide distribution, the species is quite rare in collections. It is exceedingly close to the common *A. capra*, of which it possesses the build. The structural differences pointed out by de Saussure do not appear to hold good in my specimens. It is best distinguished from *A. capra* by the color, having the clypeus black in the female, the thorax black except for the pronotal margin, and the first two abdominal segments only with yellow fasciae in the female; the fascia of the first tergite is conspicuously wide, with a black median notch; the wings are fuscous-violaceous. The only definite structural difference I can discover resides in the sculpture of the propodeum: the sides (ventral areas) and the concavity are not shiny as in *A. capra*, but dull and uniformly shagreened or alutaceous. The clypeus appears to be slightly wider than in *A. capra*.

The male, which has not hitherto been described, is quite similar to the female, but the posterior tergites also possess yellow apical fasciae, which are extremely narrow on the fifth and sixth; the clypeus is entirely yellow and the wings are much less infuscated and but slightly violaceous. The shape of the antennae is as in the male of *A. capra*, from which it differs mainly in the dull, shagreened propodeum, as described for the female.

Although reminding somewhat in coloration of *A. unifasciatus*, *A. spinolae* is not allied to that species, differing, *inter alia*, in the absence of a longitudinal furrow at the base of the second sternite.

The type (♀), of the Spinola Collection, is presumably at the Museum of Turin, Italy. The allotype, a ♂ from Long Beach, Long Island, is at the Academy of Natural Sciences of Philadelphia.

16. **Ancistrocerus capra** (H. de Saussure)

Odynerus (*Ancistrocerus*) *capra* H. de Saussure, Rev. Mag. Zool., (2), IX, 1857, p. 273 (no sex). (United States and Canada; no type locality mentioned.)

Ancistrocerus capra H. de Saussure, Synopsis of American Wasps, 1875, p. 163 (♀ ♂).

Specimens examined: CANADA: Val Morin (C. J. Quellet); Joliette; Montreal. NOVA SCOTIA: Truro (R. Matheson). MAINE: Great Lake Stream (A. P. Morse); Mt. Desert (Bar Harbor, Great Pond, and S. W. Harbor;—C. W. Johnson. N. E. Harbor; —C. S. Minot); Orrs Island and Capens (C. W. Johnson); Little Black River Rapids (J. A. Cushmann). NEW HAMPSHIRE: Glen House; Bretton Woods; and Hanover (C. W. Johnson); Mt. Washington (F. W. Dodge). MASSACHUSETTS: Sherborn (E. J. Smith); Forest Hills (J. Bequaert); Stony Brook Reservation and Peabody (L. H. Taylor); Malden (L. W. Swett); Wollaston (F. H. Sprague); Wareham (O. Bangs); Tyngsboro (F. Blanchard); Beverly; Mt. Everett; Allston, Boston; Brookline; Gloucester; and Chester (C. W. Johnson); Wellesley (A. P. Morse); Lexington (N. Banks); Cambridge; Nahant; Salem. RHODE ISLAND: Buttonwoods (C. W. Johnson). VERMONT: Bennington and Killington Pk. (C. W. Johnson); Grand Isle; Woodstock (A. P. Morse); Chittenden (J. Bequaert). NEW YORK: New Russia, Essex Co. and Ithaca (J. C. Bradley); Cranberry Lake (C. J. Drake); Keene Valley (H. Notman); Oliverea, Catskills; Cold Spring Harbor; Long Beach, Long Island; Gardiner's Island; White Plains; Van Cortland Park, New York City; and Staten Island (J. Bequaert); Flatbush, Long Island; Inwood, New York City; Southfields; Fort Montgomery (F. M. Schott); Indian Lake, Sabael (H. G. Barber); Sea Cliff, Long Island (N. Banks); Long Island (Aqueduct; Rockaway Beach; Wading River); West Point; Wilmington; De Bruce, Sullivan Co. (W. T. Davis). NEW JERSEY: Ramsey; Bear Swamp near Ramsey; Palisades; Fort Lee; Englewood (J. Bequaert); Trenton (Abbott). PENNSYLVANIA: Rockville (N. Banks); Mauch Chunk. DELAWARE. VIRGINIA: Glencarlyn and Falls Church (N. Banks). NORTH CAROLINA: Loverings (A. P. Morse); N. Fork Swannanoa, Black Mts. (N. Banks). WEST VIRGINIA: Morgantown (L. H. Taylor). WISCONSIN: Beaver Dam (W. E. Snyder). ILLINOIS:

Algonquin. Iowa. Nebraska: West Point. Minnesota: Lake Park (C. H. Waldron). Colorado: Chimney Gulch, Golden (Oslar); Plainview, Jeffreys Co. (G. P. Engelhardt). Montana: Helena. Idaho: Moscow. Oregon: Mt. Hood. It has also been recorded from Connecticut, Tennessee, Missouri, and Louisiana.

As noted by de Saussure, *A. capra* "is literally the American representative of the *O. antilope* of Europe."[35] After a careful comparison of a series of specimens of both species, I am unable to point out any consistent structural difference. It might perhaps be more rational to regard them as geographical forms of the same species. *A. antilope* (Panzer) is, as a rule, more abunddantly marked with yellow on the abdomen and less so on the thorax; although, as far as markings go, there are specimens that might almost be matched in both species. The abdominal fasciae are wider in *antilope* and there is often a yellow spot before the tip of the last tergite in the female, which I have never seen in *A. capra*. The fasciae are unusually wide in the Colorado specimens, but even these lack the spot on the apical tergite.

The type and allotype are in de Saussure's collection at the Natural History Museum of Geneva, where they were seen by Mr. N. Banks.

Ashmead[36] mentions that T. W. Fyles saw this species provision its nest with the larvae of the larch saw-fly, *Lygaeonematus erichsoni* (Hartig). The Peckhams[37] have described a nest of this species located in a large tin horn; it was provisioned with caterpillars. Mr. and Mrs. P. and N. Rau[38] found the nest at Eureka, Missouri, in woody elder twigs, placed in linear series; they also obtained a species of *Chrysis* as parasite. M. W. Blackman and H. H. Stage[39] bred this species from dead hickory wood at Syracuse, New York. L. H. Taylor[40] induced *A. capra* to nest in glass tubes inserted in holes bored in blocks of wood. He

[35] See A. v. Schulthess' description of that species, Fauna Insect. Helvetiae, Hym., Diploptera, 1887, p. 51.

[36] Psyche, VII, 1894, p. 77.

[37] Bull. Wisconsin Nat. Hist. Soc., n.s., I, 1900, pp. 91–93.

[38] Wasp Studies Afield, 1918, pp. 345–346.

[39] Techn. Publ. no. 17, New York State College Forestry, Syracuse, 1924, p. 195.

[40] Psyche, XXIX, 1922, pp. 56–60.

found that its habits are quite similar to those of *A. parietum* (= *A. tardinotus* Taylor). The egg stage lasts two days, the larval instars fifteen days, and the pupa sixteen days (at Forest Hills, Mass.). Only caterpillars were observed as prey. The habits of *A. capra* do not differ from those of *A. antilope* as described by J. O. Westwood.[41]

17. **Ancistrocerus navajo** new species

Female.—Head subcircular, seen in front. Clypeus nearly heart-shaped in outline, about as broad as long; its apical margin broadly truncate, but slightly sinuate, with very blunt edges; moderately convex. Vertex with a tranverse, curved, flattened area, covered with dense hair and bearing two minute foveae close to the middle line (as in *A. capra*). Temples well developed in the upper part, where they are broader than an eye in profile, gradually narrowed below, margined by a sharp rim which continues uninterruptedly behind the vertex. Inner orbits about as far from each other on the vertex as at the clypeus. Ocelli in a flattened triangle, the posterior ones about as far from each other as from the inner orbits. Mandibles decussate, relatively short and broad, their inner margin with three widely spaced, narrow notches, the apex very blunt and not curved. Antennae as in *A. capra*. Thorax seen from above about twice as long as its greatest width, relatively wider than in *A. capra*, but of the same general build and structure: anterior margin of pronotum bluntly rounded off dorsally, strongly rimmed on the sides, below the rounded and faintly marked humeral angles; no trace of epicnemial suture; parapsidal furrows quite deep, continuing to the anterior margin of the mesonotum. Propodeum as in *A. capra*: the concavity completely enclosed by a sharp rim which is higher along the inferior ridges; the lateral angles distinct, but bluntly rounded off; the superior ridges are separated from the postscutellum by a deep notch and then curve downward to the middle of the cavity where they join a median carina; the posterior face of the propodeum thus consists of two, well-marked, pentagonal areas. Legs normal, decidedly stouter than in *A. capra*. Wing venation of the usual type, showing no difference from that of *A. capra*. Abdomen broadly oval and stubby, somewhat wider than in *A. capra*. First tergite with a sharp, straight, and continuous carina between the anterior slope and the posterior, horizontal area; about twice as wide at the carina as the postsutural area is long in the middle. Second tergite about as broad as long. The apical margins of the second to fifth tergites are slightly raised, which is not the case in *A. capra*. Second sternite as in *capra*, uniformly low convex, gently rounded off before the base.

[41] Trans. Ent. Soc. London, 1, 1835, pp. 78–80.

Puncturation coarse and dense on the head; that of the clypeus deep, but more remote, somewhat rugose toward the apex which is deeply depressed in the middle and ends in a short, smooth lamella; the puncturation is equally coarse on the thorax, but somewhat more remote, especially on the dorsal face where the smooth and shiny intervals bear much finer, microscopic punctures. The concavity and the ventral areas of the propodeum, as well as the true metapleura, are almost entirely deprived of sculpture, being very smooth and shiny. First tergite densely covered with moderately deep punctures which are coarser before the apical margin; second tergite quite distinctly punctured all over, the punctures rather fine near the base, gradually becoming deeper and denser posteriorly and being quite coarse before the apical margin. The following tergites also rather coarsely punctured posteriorly. On the sternites, which are shiny, the puncturation, though scattered, is much more abundant and deeper than in *A. capra*, especially toward the hind margins. The whole body is covered with a long, grayish fuscous pubescence, which is especially abundant on the dorsal areas of the propodeum and on the basal slope of the first tergite. In addition the second tergite is covered with a black, somewhat velvety bloom, giving it a rather dull appearance.

Black, with the following orange-yellow markings: clypeus except for a median, oval, black spot and narrow, black margins; a small spot between the insertion of the antennae; a faint spot in the upper part of the temples; a spot near the base of the mandibles; the entire scape and a broad streak along the under side of the flagellum; the anterior margin of the pronotum dorsally; tegulae, a spot on the mesopleura, below the base of the wing; a small spot on each side of the scutellum; broad apical fasciae on tergites one to five and sternites two to five, a large spot on the middle of the sixth tergite; the band of the first tergite slightly emarginate on the middle; that of the second tergite considerably widened on the sides where it connects with an angulate, lateral spot; the bands of the fifth tergite and of the third, fourth, and fifth sternites are bisinuate. Apical third of femora and entire tibiae and tarsi ferruginous yellow. Wings but slightly smoky, more infuscated and purplish in the marginal cell and near the apex, somewhat russet toward the base.

Length of holotype (h. + th. + t. 1 + 2), 13.5 mm.; of female paratype, 12 mm.

Male.—Clypeus short pentagonal, a little wider than long; the rather narrow apex semicircularly emarginate with sharp lateral teeth. Vertex without fovea. Antennal hook as in *A. capra*, short, when folded underneath the flagellum only reaching to half-way the length of the eleventh segment. The

sculpture, pubescence and coloration much as in the female; scape black above; apical fascia of second tergite not produced on the sides; the sixth tergite and sternite with an apical band; the seventh tergite without spot.

Length (h. + th. + t. 1 + 2) of allotype, 10.5 mm.; of male paratypes, 9.5 to 11 mm.

Holotype, female, and *allotype,* male, from Post Creek Canyon, Pinaleño Mountains, Fort Grant, Arizona, July 17, 1917 (J. Bequaert). *Paratypes:* four males from the same locality and date and one female from Jemez Springs, 6,400 ft., New Mexico, August 7, 1916 (John Woodgate; Collection of Cornell University); four specimens at the Academy of Natural Sciences of Philadelphia, merely labeled Colorado (♀), Montana (♀), Arizona (♂), and California (♂).

The type and allotype have been deposited at the Academy of Natural Sciences of Philadelphia.

This species is structurally quite close to *A. capra,* of which it might perhaps be regarded as a peculiar race. Yet the puncturation of the abdomen is strikingly different. It is readily recognized by its orange-yellow livery which resembles to an astonishing degree that of the two social wasps, *Polistes navajoe* Cresson (which is probably a race of *P. canadensis*) and *Megacanthopus flavitarsis* (de Saussure), and of the syrphid fly *Sphiximorpha loewii* (Williston). These four species of insects were all taken in Post Creek Canyon.

In the female of Jemez Springs, New Mexico, the markings are more yellow than orange, there is no angular projection of the apical band on the sides of the second tergite, and the yellow of the clypeus is divided into four spots. The sculpture is the same as in the holotype and the apical tergite bears a median yellow spot. The apical spot is, however, absent in the two female paratypes from Montana and Colorado.

18. **Ancistrocerus waldenii** (Viereck)

Odynerus (*Ancistrocerus*) *waldonii* Viereck, Ent. News, xvii, 1906, p. 304 (♀). (Type locality: New Haven, Connecticut.)

Odynerus (*Ancistrocerus*) *waldenii* Viereck, Ent. News, xvii, 1906, p. 350 (correction of name); Hymenoptera of Connecticut, 1916, pp. 636 and 638. E. J. Smith, Canadian Entom., liv, 1922, p. 87 (♀).

I have seen specimens from the following localities: Newfoundland: Port aux Basques; Cape Ray. Nova Scotia:

Truro (R. Matheson); Millsville. MAINE: Mt. Cadillac and Bar Harbor, Mt. Desert; Eastport; Orrs Island (C. W. Johnson). NEW HAMPSHIRE: Alstead (A. P. Morse); Claremont (R. P. Dow); Glen House (C. W. Johnson). MASSACHUSETTS: Sherborn (E. F. Smith); Lexington (N. Banks); Peabody; Stony Brook Reservation (L. H. Taylor); Needham; Winchendon; Wollaston; Wellesley (A. P. Morse); Southbridge (C. W. Johnson). VERMONT: Danbury (C. W. Johnson); Chittenden (J. Bequaert); Ascutney (A. P. Morse). CONNECTICUT: New Haven (holotype ♀; B. H. Walden). NEW YORK: West Danby and Ithaca (J. C. Bradley); Ft. Montgomery (F. M. Schott); Ramapo (W. T. Davis). NEW JERSEY: Millburn; Ramsey; and Palisades (J. Bequaert). MARYLAND. VIRGINIA.

The usual coloration of the female is as follows: Black with the following white markings: four large spots on the clypeus, often covering most of the surface; a spot between the insertion of the antennae; a spot in the upper part of the temples behind the eyes; a small spot on the basal half of the mandibles; a dorsal band on the anterior margin of the pronotum; tegulae, except for a median dark spot; a wide band on the scutellum; a spot on the mesopleura, below the base of the wing; sometimes two small dots on the postscutellum; broad apical fasciae on tergites one to five and sternites two to four or five; the band of the first tergite not or but little widened laterally; a large spot before apex of sixth tergite; knees, tibiae, and tarsi; the tibiae more or less ferruginous or black on the under side. In all specimens seen the antennae, posttegulae, and propodeum are entirely black. I have seen but one female that lacked the apical spot of the sixth tergite, but in another it is quite minute. The species is readily recognized from *albophaleratus* by the short and stubby thorax and the more prominent lateral angles of the propodeum. In addition, the superior ridges of the propodeum are quite low in their upper part, not being separated from the postscutellum by a deep notch. *A. birenimaculatus* approaches *waldenii* in the structure of thorax and first tergite, but differs in the clypeus and the prominent superior ridges of the propodeum. The sculpture of the clypeus is much finer in *waldenii* than in *albophaleratus*.

Male (undescribed).—Structurally similar to the female, having the short and stubby thorax, which seen from above is about

as long as broad, and the short and wide first tergite. Clypeus heart-shaped, about as long as broad, smooth, shiny, with very sparse and exceedingly fine punctures; its apex is very deeply cut out, the emargination being as deep as the distance between the apices of the long and sharp teeth. Antennae as in *albophaleratus;* the terminal hook finger-shaped, straight, sharply pointed at apex, which reaches to the base of the eleventh segment. Black, with the following white markings: clypeus entirely; a spot between insertion of antennae; a dot behind the eye in upper part of temples; the under side of the scape; anterior margin of pronotum above; tegulae, except for a blackish spot; two spots on scutellum (sometimes absent), broad apical fasciae on tergites one to six and on sternites two to five; knees, tibiae, and tarsi and a spot on the under side of middle coxae. The tip of the flagellum is somewhat ferruginous beneath. Length (h. + th. + t. 1 + 2) of allotype (Peabody, Mass.): 7 mm.; of male paratypes: 7 to 7.5 mm. In coloration the male is exactly like that of *albophaleratus,* from which it is readily recognized by the stubby thorax and first tergite and by the very deep emargination of the clypeus. The shape of the clypeus and low superior ridges of the propodeum will also separate it from the male of *birenimaculatus.*

In collections *A. waldenii* has been generally confused with *albophaleratus,* since it frequently occurs together with that species and is colored much like it. Mr. E. J. Smith, to whom credit is due for its rediscovery in Massachusetts, has called my attention to de Saussure's remark, following the description of *A. albophaleratus*:[42] "We possess one individual ♀, having the form sensibly more stubbed, which has the clypeus white, with a black spot and the scutellum almost entirely white. (Illinois). Is it a simple variety?" There is little doubt that that specimen belonged to *A. waldenii.*

The type (♀) is in the entomological collection of the Connecticut Agricultural Experiment Station, New Haven. I have had opportunity to examine it through the kindness of Dr. W. E. Britton. The allotype (♂) is at the Academy of Natural Sciences of Philadelphia. Paratypes (♂) are in my collection and at the Boston Society of Natural History.

[42] Syn. Amer. Wasps, 1875, p. 168.

I have a female from Warren, Idaho Co., Idaho, which is structurally quite close to *waldenii*, having the same short and stubby thorax and first tergite, and quite low superior ridges of the propodeum. The whitish markings are, however, much reduced on clypeus, thorax (which has only the anterior margin of the pronotum and the tegulae white), abdomen (only two first tergites with apical fasciae and lateral spots at apex of second sternite), and legs; but the scape and entire flagellum are extensively pale on the under side. I regard this as a color variety of *A. waldenii*.

19. **Ancistrocerus birenimaculatus** (H. de Saussure)

Odynerus (*Ancistrocerus*) *birenimaculatus* H. de Saussure, Et. Fam. Vesp., I, 1852, p. 135 (♀). (Type locality: Carolina.)

Ancistrocerus birenimaculatus H. de Saussure, Synopsis of American Wasps, 1875, p. 175 (♀ ♂).

Specimens examined: MASSACHUSETTS: Wellesley (A. P. Morse); Springfield (G. Dimmock); Framingham (C. A. Frost); Milton (Brooks); Ware (F. E. Zeissig); Holliston (N. Banks); Cambridge (Robinson); Taunton (G. W. Pepper). CONNECTICUT: Stonington. NEW YORK: Flushing, Long Island (E. L. Bell); Massapequa, Long Island (W. T. Davis). NEW JERSEY: Fort Lee (J. Bequaert); Cape May Co. (W. T. Davis); Newfoundland; Cape May Courthouse. PENNSYLVANIA. TEXAS: Fedor, Lee Co. (Birkmann).

In the male and more rarely in the female, the lateral, free spots of the second tergite often become quite minute and occasionally they are absent. As such specimens are bred from the same nest with normally colored examples, they can not even be regarded as a distinct variety. Moreover, de Saussure's original description was based upon a female that happened to lack the spots, unless they were overlooked. The species is readily recognized in both sexes by the stubby build and the unusually wide clypeus.

H. de Saussure compares this species with the European *A. renimacula* (Lepeletier), but it is not structurally related to that species, which is extremely close to *A. parietum*. I know of no true relative of *A. birenimaculatus* in the Palaearctic fauna.

The type (♀) is probably at the Paris Museum; the allotype (♂) in de Saussure's collection at the Natural History Museum of Geneva.

This species builds irregular lumps of coarse, hardened clay, 35 to 40 mm. in diameter, containing from six to twenty cells or more, and attached to small twigs of low bushes, leaves being sometimes imbedded in the clay. The cells are near the center, arranged somewhat radially, and with a thin, silky lining. The nest was first briefly described and figured by A. S. Packard[43] from an example found at New Haven by A. E. Verrill. Later C. V. Riley[44] noticed its occurrence at Vineland, New Jersey, and recorded the ichneumonid wasp *Acroricnus junceus* (Cresson) as its parasite. A more detailed account, with figure, was published by E. Strand,[45] from a nest collected by Mr. C. A. Frost, at Framingham, Mass. Mr. C. W. Johnson[46] has shown that this species is decidedly protandrous: of four different nests the males invariably appeared first, in the latter part of May. He also obtained from two of the nests *Acroricnus junceus* (Cresson), which was bred from the same *Ancistrocerus* by Mr. W. T. Davis and Mr. Nathan Banks, and is known to attack several other North American eumenids. The nest of *A. birenimaculatus* is figured by Viereck[47] and by F. E. Lutz.[48]

A. Davidson[49] has described a nest of a Californian wasp which he refers to "*Ancistrocerus birenimaculatus:*" it consisted of a number of cells placed in a hollow stem of a plant, either in series or grouped together laterally. The architecture is so fundamentally different from that of the eastern *birenimaculatus*, that the Californian wasp was undoubtedly misidentified. Moreover, I have not seen true *A. birenimaculatus* from California, but I have female and male of an *Ancistrocerus* from Pacific Grove, California (W. M. Mann), which are colored much like that species and have also a short and stubby thorax; they differ, however, in the structure of the clypeus and propodeum and I feel certain that they are specifically distinct.

[43] Guide to the Study of Insects, 1869, p. 156, pl. v, fig. 12.

[44] Amer. Entom., III, 1880, p. 154.

[45] Strand, E. 1914. Ein nordamerikanisches Eumenidennest nebst descriptiven Bemerkungen über die zugehörigen Wespen. Ent. Mitt. Berlin, III, pp. 116–118.

[46] Psyche, XXX, 1923, pp. 226–227.

[47] Hymenoptera of Connecticut, 1916, pl. IV, fig. 1.

[48] Field Book of Insects, 1921, pl. XC.

[49] Davidson, A. 1899. Notes on California wasps; the nesting habits of *Ancistrocerus birenimaculatus* Sss. Ent. News, X, pp. 180–181.

20. **Ancistrocerus parietum** (Linnaeus)

Vespa parietum Linnaeus, Syst. Naturae, 10th Ed., I, 1758, p. 572 (no sex; no locality).

Odynerus (*Ancistrocerus*) *parietum* Wesmael, Bull. Ac. Sci. Bruxelles, III, 1836, p. 47 (♀ ♂; in part). C. G. Thomson, Hymenoptera Scandinaviae, III, 1874, p. 74. A. v. Schulthess, Fauna Insect. Helvetiae, Hym., Diploptera, 1887, p. 53 (♀ ♂).

Ancistrocerus tardinotus "Bequaert" L. H. Taylor, Psyche, XXIX, 1922, p. 49 (no description; account of habits).

Specimens examined: MASSACHUSETTS: Forest Hills (many ♂ and ♀, some of them bred and others collected in the open; L. H. Taylor and J. Bequaert; July 1919 and June 1921); Salem, June 1919 (2 ♀; F. H. Walker); Essex Co. (E. J. Smith). NEW YORK: Flatbush, Long Island, August 9, 1917 (F. M. Schott); Ithaca, July 24 and August 7, 1916. NEW JERSEY: Englewood, June 1918 (1 ♂; J. Bequaert).

My attention was first called to this insect by Mr. Taylor, who observed its nesting habits near Boston, during the summer of 1921, when it was one of the more common species at Forest Hills. It was evident at the time that it was closely allied to the European *A. parietum;* on the supposition that it might have been the indigenous, American representative of *parietum*, it was tentatively named *A. tardinotus.* Subsequently I have compared it with a long series of *A. parietum* from Belgium, France, and Germany and I have been unable to discover any difference whatsoever in structure, sculpture, and livery. Moreover, as I have failed to find it in any of the older collections of Hymenoptera, I have reached the conclusion that it is a recent importation from Europe. The earliest capture was near Ithaca, New York, in 1916. It is the second species of diplopterous wasps accidentally introduced by man. *Vespa crabro* Linnaeus appears to have been seen for the first time in America in 1854 and there is a specimen at the U. S. National Museum labelled "West Farms, New York, 1860." Nowadays it is found along the Atlantic seaboard in Connecticut, New York, New Jersey, and Pennsylvania, but has seemingly been unable to migrate inland. It will be interesting to follow the spread of *A. parietum.*

Since the species is not mentioned in de Saussure's Synopsis, the following description is appended.

Female.—Moderately short and stubby species, much of the shape and appearance of *A. catskillensis*. Clypeus almost heart-shaped, a little broader than high, slightly convex; the apical margin nearly one-third of the whole width, very slightly arcuately sinuate, not dentate laterally, though with prominent, blunt edges. Vertex with a faint transverse depression and two minute, hairy foveae. Antennae elongate, the flagellum but slightly and quite gradually thickened. Thorax seen from above about one and one-third to one and one-half times as long as wide; seen from the side much longer than high. Pronotum not rimmed along the anterior margin and with blunt humeral angles, followed by a lateral carina which runs out to the fore coxae. Mesonotum but slightly flattened before the scutellum, with conspicuous parapsidal furrows in its posterior half. Scutellum broadly rectangular, slightly convex, with a deep, but fine, median, depressed, longitudinal line. Postscutellum with an anterior, horizontal and slightly swollen, and a posterior, longer, vertical area, without crest, but slightly depressed longitudinally in the middle. Mesopleura without epicnemial suture. Propodeum short, without horizontal portion medially behind the scutellum; its posterior face abruptly vertical, the concavity but slightly depressed, divided by a median, low carina and completely enclosed by a sharp rim, which forms two pentagonal areas; the superior ridge forms a slight, blunt angle on either side above, separated by a shallow groove from the postscutellum; lateral angles moderately prominent, blunt and broad. Abdomen broadly oval, distinctly depressed. First tergite transverse, with a strong transverse carina, which is nearly straight and briefly interrupted medially; the postsutural area broadly rectangular, over twice as broad as long. Second tergite as wide at the base as the first, slightly wider than long; its apical margin simple, flat. Second sternite, viewed sideways, without convexity, uniformly flattened or even somewhat depressed at the base in the middle. Wing venation of the usual type, not appreciably different from that of *A. catskillensis*. Punctuation coarse and dense on most of the head and thorax; clypeus shiny, smooth, except for a few regularly scattered, medium-sized punctures. Ventral lateral areas and concavity of the propodeum dull; the concavity finely, transversely striate; the ventral lateral areas more coarsely rugose, especially in the upper part. Sculpture of the abdomen much finer than on the thorax; the punctures of the postsutural area of the first tergite quite strong, but spaced; those of the shiny second sternite also stronger and more abundant. Head, thorax and first abdominal tergite with long, gray pubescence.

Black, with the following markings bright yellow (nearest yellow-chrome of Ridgway's color nomenclature): on the clypeus

two large triangular spots occupying the upper angles and a transverse band somewhat emarginate above, before the apex; these spots often more or less confluent; a spot between the insertions of the antennae; an elongate dot behind the eyes in the upper part of the temples; a spot near the base of the mandibles; the anterior face of the scape; a broad fascia on the anterior margin of the pronotum; a spot below the tegulae, on the upper plate of the mesepisternum; tegulae except for a median, brownish spot; a transverse fascia on the scutellum, more or less interrupted in the middle; a broad apical fascia on tergites one to five; that of the first tergite very wide, especially on the sides where it nearly reaches the suture; the yellow of the first tergite is rather irregularly emarginate anteriorly by a more or less triangular or half-moon shaped black spot; a triangular or rounded spot on the sixth tergite (sometimes absent); apical fasciae on sternites two to five, those on sternites two and three twice emarginate, the succeeding divided into three spots; the apical part of the femora; and the tibiae entirely. Antennal flagellum very faintly ferruginous on the under side or entirely black. Tarsi ferruginous yellow. Wings hyaline, slightly brownish with faint purple tinge in the apical half of the radial cell.

Male.—Differs from the female in the following points only: Clypeus more elongate, about as high as its greatest width, irregularly hexagonal; its apical margin narrower, more deeply, arcuately emarginate, the lateral angles prominent and tooth-like. Vertex without trace of a depression. Internal orbits much closer to each other at the clypeus than on the vertex, the distance between them below the insertion of the antennae about the length of the antennal scape. Antennae slender; their flagellum very gradually inflated toward the middle, thence uniformly thick to the apex, none of its segments swollen nor beaded; scape slender, about as long as the two succeeding articles; third antennal segment distinctly longer than the fourth; the fourth, fifth, and sixth subequal, longer than thick; the succeeding nearly as thick as long; the thirteenth segment or hook short, digitiform, straight, gradually narrowed at the apex into a blunt point which reaches the base of the tenth segment. Clypeus uniformly dotted with scattered, superficial punctures. Coloration in the main like that of the female; labrum and clypeus entirely, and mandibles, except apex and margins, yellow; mesopleura and seventh tergite without yellow spot; the yellow spots of the scutellum smaller, sometimes reduced to dots. There is also a narrow yellow streak along the inner orbits, below the sinus of the eyes. The fore and middle femora are more extensively yellow below and there is a spot of the same color on the under side of the coxae. Under side and apex of the flagellum pale ferruginous.

The flattened second sternite separates *A. parietum* readily from all other North American species known to me.

L. H. Taylor[50] has published a detailed account of the habits of *A. parietum*, which he induced, at Forest Hills, Massachusetts, to nest in glass tubes of six to eight millimeters inside diameter, inserted in holes bored in blocks of wood. The female stores caterpillars in a series of one to four cells placed in linear succession and separated by partitions of mud about one millimeter in thickness. Each cell is at first provided with an egg suspended by a filament from above; some three to fourteen paralyzed caterpillars are then rapidly brought in and the cell is closed before the egg hatches. In the summer generation the egg stage lasts three days, the larval stages ten to fourteen days, and the pupal stage eleven to fourteen days; the males and females bred from these summer nests were kept alive as long as three months. The outermost occupant of the linear series of cells is the first to emerge, although it is necessarily the product of the most recent egg laid by the mother-wasp. The individuals first emerging are males. The inner cells, which produce the females, are generally larger than the outer ones giving the males. Thus in Massachusetts there are two generations a year and quite probably each female constructs more than one nest. The wasps of the second generation hibernate as larvae. From Taylor's account the habits of *A. parietum* in America show no departure from what they are in Europe,[51] where the nest is generally placed in crevices or galleries of walls, banks of clay, timber, or decaying tree stumps. Verhoeff has observed that, although the usual prey is caterpillars, the females sometimes store larvae of beetles (*Melasoma populi* Linnaeus).

21. **Ancistrocerus albophaleratus** (H. de Saussure)

Odynerus (*Ancistrocerus*) *albophaleratus* H. de Saussure, Et. Fam. Vesp., III, 1856, p. 217 (♀ ♂). (Described from Arctic America, without more definite type locality.)

Ancistrocerus albophaleratus H. de Saussure, Synopsis of American Wasps, 1875, p. 167 (♀ ♂).

I have seen specimens from the following localities: ANTICOSTI: Ellis Bay (W. S. Brooks). NEWFOUNDLAND: Cape Ray. CAN-

[50] Psyche, XXIX, 1922, pp. 49–55.

[51] See C. Verhoeff, Berlin. Ent. Zeitschr., XXXVII, (1892) 1893, pp. 467–479; C. Ferton, Actes Soc. Linn. Bordeaux, XLVIII, 1895, pp. 225–227.

ADA: Val Morin (C. J. Quellet); Joliette; Montreal. NOVA SCOTIA: Truro (R. Matheson). MAINE: Orrs Island; Capens (C. W. Johnson); Mt. Desert (S. W. Harbor, Bar Harbor, and Mt. Cadillac;—C. W. Johnson). NEW HAMPSHIRE: Glen House; Hanover; Intervale; Base Station; Jaffrey; Mt. Monadnock; Half Way House, Mt. Washington (C. W. Johnson). MASSACHUSETTS: Forest Hills; Stony Brook Reservation (L. H. Taylor); Sherborn (E. J. Smith); Lexington (N. Banks); Blue Hills; Provincetown; Stowe (A. P. Morse); Wollaston (Sprague); Tyngsboro (F. Blanchard); Brookline (C. W. Johnson); Salem. VERMONT: Chittenden (J. Bequaert); Newport (A. P. Morse). NEW YORK: Oliverea, Catskills (J. Bequaert); Ithaca (N. Banks); Keene Valley (H. Notman); Cranberry Lake (C. J. Drake); Potsdam. MARYLAND. COLORADO: Troublesome, 7,345 ft. and Florissant (S. A. Rohwer). IDAHO: Moscow. WYOMING: Wind River; Yellowstone Park (J. C Bradley). NORTH DAKOTA: Fargo (O. A. Stevens). NEW MEXICO: Cox Canyon, Sacramento Mts., 9,300 ft. (W. M. Wheeler); Beulah (H. Skinner). MANITOBA: Winnipeg (Scudder). ALBERTA: Bilby (G. Salt). VANCOUVER. BRITISH COLOMBIA: Revelstoke, Selkirk Mts. and Downie Creek, Selkirk Mts. (J. C. Bradley). ALASKA: Fox Point and Kukak Bay (T. Kincaid).

This is on the whole a northern species. It has also been recorded from Connecticut, Pennsylvania and Illinois. Ashmead[52] has listed it from Alaska, this being the only solitary wasp known from that country.

The female of this species is black with the following creamy-white markings: two or four spots on the clypeus, the upper ones the largest; a small spot above insertion of antennae; under side of scape; a minute spot near inner orbits, above clypeus; an elongate spot behind the eyes above; anterior margin of pronotum; most of the tegulae; a spot (rarely absent) on mesopleura below the base of wings; two small or large spots or a band on scutellum and two smaller spots (often absent) on postscutellum; broad apical fasciae on tergites one to five or one to four and on sternites two and three or two to four; the knees and the upper side of the tibiae. In all specimens seen the posttegulae are black and the last tergite has no pale spot; and I have only found one female in which the propodeum bears two small, whitish spots on

[52] Proc. Washington Ac. Sci., IV, 1902, p. 134.

the projecting edges. The males have the clypeus entirely and the legs more extensively whitish, but the thorax is generally less marked, sometimes almost wholly black. In both sexes the flagellum is but faintly ferruginous on the under side toward the tip and in the female it is often entirely black. The pale markings of the male frequently are more yellowish than creamy-white.

The type and allotype are probably at the British Museum.

L. H. Taylor[53] found at Forest Hills, Massachusetts, that *A. albophaleratus* also may be induced to nest in glass tubes inserted in wood. Under such conditions its habits are similar to those of *A. parietum*. The whole development of the summer generation takes about thirty-two days (egg stage, three days; larva, sixteen days; pupa, thirteen days). Frequently, however, this species builds free clay cells inside some hollow. A. S. Packard[54] found the cells in a deserted gall of *Cynips confluens* (Harris), the common, large "oak-apple;" they were several in a row, arranged around one side of the gall, side by side, with the holes pointing toward the center of the gall; the cells were half an inch long, and one-half as wide, being formed of small pellets of mud, giving a corrugated, granulated appearance to the outside, while the inside was lined with silk. I have seen two similar nests built by *A. albophaleratus* and apparently placed in the same kind of gall, in the collection of the Museum of Comparative Zoölogy; one was collected at Wollaston, Massachusetts, by F. H. Sprague and the other at Beverly, Massachusetts, by J. H. Emerton. The prey, as observed by Packard, consists of lepidopterous larvae. The males of this wasp are often taken at flowers of *Salix, Solidago canadensis* and *Aralia hispida.*

22. **Ancistrocerus tigris** (H. de Saussure)

Odynerus (*Ancistrocerus*) *tigris* H. de Saussure, Rev. Mag. Zool., (2), IX, 1857, p. 273 (no sex). (Type locality: Pennsylvania.)

Ancistrocerus tigris H. de Saussure, Synopsis of American Wasps, 1875, p, 160 (♀ ♂).

I have seen specimens from the following localities: VERMONT: Mt. Equinox; Ascutney (A. P. Morse); Chittenden (J. Bequaert); Bennington (C. W. Johnson). MAINE: Capens; Calais; Monmouth; Mt. Desert (S. W. Harbor; Great Pond; Narrows; Bar

[53] Psyche, XXIX, 1922, pp. 60–61.

[54] Guide to the Study of Insects, 1869, pp. 155–156, pl. v, fig. 13.

Harbor; Echo Lake;—C. W. Johnson). NEW HAMPSHIRE: Claremont (R. P. Dow); Mt. Washington (C. W. Johnson); White Mountains (Packard). MASSACHUSETTS: Milton (Brooks); Auburndale; Beverly; Sandwich; Blue Hills; Brookline (C. W. Johnson); Natick (C. A. Frost); Walpole (Sprague); Sherborn; Scituate; Winchendon; Wellesley; Needham; and Provincetown (A. P. Morse); Forest Hills; Duxbury; and Stony Brook Reservation (L. H. Taylor); Lexington (N. Banks); Nahant; Cambridge. CONNECTICUT: Salisbury (A. P. Morse); Colebrook (W. M. Wheeler). RHODE ISLAND: Block Island (A. P. Morse). NEW YORK: Kaaterskill High Peak (3,800 ft.) and Ithaca (A. P. Morse); Keene Valley (H. Notman); Ft. Montgomery (F. M. Schott); Long Island (Cold Spring Harbor, Springs, and Central Park); Yonkers; Gardiner's Island; Staten Island; Oliverea, Catskills; and West Nyack (J. Bequaert); Portage; West Point; Long Island (Long Pond; Pennyquid Barrens; Rockaway Beach) (W. T. Davis). NEW JERSEY: Ramsey; Bear Swamp near Ramsey; Lakehurst; Palisades; Alpine; Englewood; and Fort Lee (J. Bequaert); Montclair (E. A. Bischoff). PENNSYLVANIA: Harrisburg (W. S. Fisher); Mauch Chunk. DELAWARE. MARYLAND: Plummer's Island (J. Bequaert). VIRGINIA: Falls Church; Great Falls; and Glencarlyn (N. Banks); Richmond. WEST VIRGINIA: Monongalia Co. (L. H. Taylor). OHIO: Sandusky. WISCONSIN: Beaver Dam (Snyder). ILLINOIS: Algonquin. SOUTH DAKOTA: Brookings. GEORGIA: Roswell (King). TEXAS: Dallas (Boll); Fedor, Lee Co. (Birkmann).

The female is, as a rule, black with the following yellow markings: the clypeus on the sides, leaving a central, more or less wedge-shaped, black spot (sometimes reduced to a dot); a median spot above insertion of antennae; a small dot along inner orbits, above the clypeus; the scape anteriorly; an elongate spot behind eyes; anterior angles of pronotum; tegulae (often ferruginous or blackish in the center); a spot on mesopleura below base of wing; two spots on scutellum (rarely almost meeting in the middle); postscutellum except for the margin (rarely divided into two spots); knees, tibiae and tarsi (the tibiae often more or less black on the under side); apical bands on tergites one to five (or one to four) and sternites two to five. In all specimens I have seen the posttegulae and the whole of the propodeum are black. The male

has the clypeus wholly and the legs, as a rule, more extensively yellow, even the under side of the coxae generally bearing large spots of that color; on the other hand the markings on the thorax are often much reduced: in some males only the pronotum has a narrow, yellow band, even the tegulae being almost completely black.

A series of females from Texas are somewhat more extensively marked with yellow than usual, although the propodeum and posttegulae are wholly black; the apical fascia of the first tergite is widened laterally where it even shows an extension toward the middle of the tergite; the pronotal band also is wider.

The type and allotype are in de Saussure's collection at the Natural History Museum of Geneva, where they were seen by Mr. Nathan Banks.

The nearest relative of this species in the European fauna appears to be *A. trifasciatus* (Fabricius), although the differences between the two are so important that they can not be regarded as races of one species. Among other points, the shape of the clypeus is totally different in the female as well as in the male.

I have bred *A. tigris* and its parasite, *Chrysis nitidula* Fabricius, from a gallery burrowed in the pith of a briar, at West Nyack. I have also a male obtained from an old cynipid oak gall at Forest Hills. Mr. and Mrs. P. and N. Rau[55] obtained it from an old nest of a mud-dauber (*Sceliphron* or *Chalybion*) at Lake View, Kansas. The males are frequently seen in the spring visiting the flowers of *Vaccinium corymbosum;* I have also taken them at those of *Aralia hispida* (also the females), *Anaphalis margaritacea* and *Chrysanthemum Parthenium.*

23. **Ancistrocerus catskillensis** (H. de Saussure)

Odynerus (*Ancistrocerus*) *catskill* H. de Saussure, Et. Fam. Vesp., I, 1852, p. 136 (♀ ♂). (Type locality: Catskill.) (Not Pl. XVI, fig. 8.)

Odynerus (*Ancistrocerus*) *catskillensis* H. de Saussure, Et. Fam. Vesp., III, 1856, p. 204 (emendation).

Ancistrocerus catskillensis H. de Saussure, Synopsis of American Wasps, 1875, p. 168 (♀ ♂).

Odynerus catskilli H. de Saussure, Synopsis of American Wasps, 1875, p. 168, (in synonymy).

The correct name of this species is either "*catskill,*" as originally spelled evidently through a misprint, or "*catskillensis*" as

[55] Wasp Studies Afield, 1918, pp. 344–345.

corrected by de Saussure in 1856. The form "*catskilli*" adopted by several modern authors, was introduced in 1875 in the synonymy of *catskillensis*.

I have seen specimens from the following localities: CANADA. MAINE: Capens (C. W. Johnson). MASSACHUSETTS: Brookline; Auburndale (C. W. Johnson); Wellesley; Needham; Sherborn; and Scituate (A. P. Morse); Forest Hills and Blue Hills (J. Bequaert); Malden; Wollaston (F. H. Sprague); Tyngsboro (F. Blanchard); Taunton (G. W. Pepper); Nahant; Cambridge. NEW HAMPSHIRE: Alstead (A. P. Morse); White Mountains. RHODE ISLAND: Buttonwoods (C. W. Johnson). CONNECTICUT: Stamford (A. P. Morse). VERMONT: Chittenden (J. Bequaert); Bennington (C. W. Johnson). NEW YORK: Ithaca (A. P. Morse); Sea Cliff, Long Island (N. Banks); Keene Valley (H. Notman); Long Island (Cold Spring Harbor and Jamaica); Oliverea, Catskills; and West Nyack (J. Bequaert); West Point (W. T. Davis). NEW JERSEY: Ramsey and Englewood (J. Bequaert). PENNSYLVANIA. ILLINOIS: Peoria and Algonquin. KANSAS. NEBRASKA: West Point. WEST VIRGINIA: Monongalia Co. (L. H. Taylor).

The usual coloration of the female is black with the following yellow markings: four spots on the clypeus, often more or less confluent on the sides; under side of scape; a spot above insertion of antennae; a line in upper part of temples, behind the eye; anterior margin of pronotum; tegulae (except for a ferruginous spot) and a spot on the posttegulae (rarely absent); a large spot on mesopleura below the base of wing; two large spots on scutellum; a broad band on postscutellum; an elongate, more or less curved spot on the sides of the propodeum; the knees and most of tibiae and tarsi (the tibiae with a black spot on the upper face and the tarsi often more ferruginous or darkened toward the tip); wide apical bands on tergites one to five and sternites two and three. The extent of the yellow on the propodeum varies considerably; sometimes it is reduced to a small dot at the edges or the two bands may be divided into four spots; but I have seen no females with entirely black propodeum. The last sternite has no yellow spot. The male is similar, but the clypeus is entirely and the legs are more extensively yellow; the propodeum, however, is either entirely black or with just an indication of yellow dots. In both

sexes the under side of the flagellum is more extensively ferruginous yellow than in *albophaleratus*, but less so than in *tigris*.

The type and allotype were described from Guérin-Méneville's collection, the present location of which is unknown to me.

Among European species *A. catskillensis* is related to *A. oviventris* Wesmael, though quite distinct specifically, especially in the much less swollen second abdominal sternite.

A. tigris, *A. catskillensis*, and *A. albophaleratus* are extremely close allies, though, I believe, quite distinct species. It is relatively easy to point out morphological differences for the females, but among the males there are frequently specimens which remain doubtful. The creamy-white color of the body markings of *albophaleratus* is not always so clearly defined from the yellow of *catskillensis* and *tigris* as one might desire. *A. tigris* is the more slender of the three, and *A. catskillensis* the more stubby since it is clearly transitional in this respect to *A. birenimaculatus*. *A. albophaleratus* combines the rather slender and somewhat flattened thorax of *tigris* with the broader abdomen of *catskillensis*.

In addition to the characters given in the key it may be noted that in the female of *tigris* the truncate apex of the clypeus is relatively narrow, between one-fifth and one-fourth the total width of the clypeus, its lateral angles being rather sharp; the surface of the clypeus is not so coarsely punctured; the scape is relatively long, while the flagellum is short and swollen; frequently the rim which encloses the cavity of the propodeum is so even that the lateral angles are hardly noticeable. In both *catskillensis* and *albophaleratus*, the truncate apex of the clypeus is wider, one-fourth or more of the total width, with bluntly rounded angles; the surface of the clypeus rather coarsely punctured, often more or less wrinkled; the scape is relatively short, while the flagellum is more slender. The angles of the propodeum are somewhat less pronounced in *albophaleratus* than in *catskillensis*.

The males of *tigris* are best recognized by the strongly swollen, somewhat beaded flagellum, the moderately emarginate clypeus, and the elongate and rather narrow first tergite. In *catskillensis* the clypeus is, as a rule, quite deeply emarginate, with long apical teeth; while in *albophaleratus* the emargination is very shallow. Both these species have the flagellum moderately and uniformly swollen, not beaded, and the first tergite is wide and short.

Notes on Additional North American Ancistroceri

In the foregoing account I have accepted but few of the synonymies that have been previously proposed. The species are so closely allied that a reliable synonymy can only be established through examination of the types, the location of which I have indicated as far as possible. Of Cameron's species some types are possibly found at the British Museum; others are in the entomological collections of Pomona College, at Claremont, California, and, through the courtesy of Professor J. C. Bradley, I had occasion to hastily examine them; there are none at the Academy of Natural Sciences of Philadelphia, as might be supposed.

The species are listed alphabetically, though the original generic reference is retained. It is quite possible that some of them are not correctly placed in *Ancistrocerus*.

Odynerus (*Ancistrocerus*) *acanthopus* Cameron.[56] Type locality: Fedor, Texas. What is perhaps the type is labeled "*Stenancistrocerus acanthopus* Cameron" in the collection of Pomona College. The first tergite shows no true transverse carina and this specimen represents a species of *Stenodynerus* allied to *O. pedestris* Saussure. Cameron's *Nortonia acanthopus*[57] from Lee Co., Texas, is apparently different; a specimen thus labeled at Pomona College, is a true *Ancistrocerus* of the subgenus *Parancistrocerus*.

Odynerus (*Ancistrocerus*) *adiabatus* H. de Saussure.[58] Type locality: Carolina. Type probably at the Paris Museum. This appears to agree quite well with *A. tigris*, especially as regards the size (h. + th. + t. 1 + 2: 6 mm.; total length, 8 mm.). If the two should prove to be synonymous, the name *adiabatus* will have precedence.

Odynerus ammonia H. de Saussure.[59] Type locality: Carolina. The type is probably at the Paris Museum. This appears to be related to *A. histrio* (Lepeletier), from which it differs, according to the description, in the presence of an orange-yellow, free dot on each side of the second tergite. H. de Saussure in 1875[60]

[56] Trans. Amer. Ent. Soc., xxxiv, 1908, p. 223 (♀).
[57] Pomona Journ. Entom., i, 1909, p. 78 (♀).
[58] Et. Fam. Vesp., i, 1852, p. 138 (♂).
[59] Et. Fam. Vesp., i, 1852, p. 144 (♀).
[60] Syn. American Wasps, p. 200.

thought that his *ammonia* might be but a variety of *A. histrio* and quite possibly such is the case. He, however, did not examine the type of *ammonia* at that time and his statement that in *ammonia* the "suture of the first (abdominal segment is) very indistinct or wanting" contradicts the original description where it is said that *ammonia* "resembles *O. histrio*, but as the latter has no suture on the first segment of the abdomen, one could not confuse them." Quite possibly *ammonia* is one of the species described in this group by Robertson.

Ancistrocerus argelus Cameron.[61] Type locality: Mexico.

Odynerus (*Ancistrocerus*) *arista* H. de Saussure.[62] Type locality: Cuernavaca, Mexico. Corrected to *Ancistrocerus aristae*, in 1875.[63] Type probably in de Saussure's collection at the Natural History Museum of Geneva.

Odynerus (*Ancistrocerus*) *arizonaensis* Cameron.[64] Type locality: Congress, Arizona.

Odynerus aztecus H. de Saussure.[65] Type locality: Tampico, Mexico. Placed by de Saussure[66] in *Ancistrocerus* and said to be closely allied to *A. quadrisectus*. Types probably in de Saussure's collection at the Natural History Museum of Geneva.

Odynerus bacu H. de Saussure.[67] Type locality: Cuba. The type, which belonged to Guérin-Méneville's collection, possibly is at the Paris Museum. In 1856,[68] de Saussure corrected the name to *O. bacuensis* and Cresson[69] misspelled this *O. bucuensis*. I have seen a male of this species and it possesses a transverse, irregular carina on the first tergite, as in *A. saecularis*. It should be placed in *Parancistrocerus*.

Ancistrocerus bakerianus Cameron.[70] Type locality: Ormsby Co., Nevada.

Nortonia (?) *basimacula* Cameron.[71] Type locality: Fedor, Texas.

[61] Trans. Amer. Ent. Soc., XXXI, 1905, p. 391 (♂).
[62] Rev. Mag. Zool., (2), IX, 1857, p. 274 (no sex).
[63] Syn. Amer. Wasps, p. 188.
[64] Trans. Amer. Ent. Soc., XXXIV, 1908, p. 208 (♀).
[65] Rev. Mag. Zool., (2), IX, 1857, p. 275 (♀ ♂).
[66] Syn. Amer. Wasps, 1875, p. 193.
[67] Et. Fam. Vesp., I, 1852, p. 185 (♂).
[68] Et. Fam. Vesp., III, p. 232.
[69] Proc. Ent. Soc. Philadelphia, IV, 1865, p. 164.
[70] Trans. Amer. Ent. Soc., XXXIV, 1908, p. 220 (♂).
[71] Trans. Amer. Ent. Soc., XXXIV, 1908, p. 224 (♀).

Ancistrocerus behrensi "Cresson" E. S. Tucker.[72] Buffalo, Colorado. Without description. In the Academy of Natural Sciences of Philadelphia, there are specimens which have been labeled "*behrensi*" by Cresson, but the species has not been described. It is evidently allied to *birenimaculatus* and *catskillensis*, though apparently distinct.

Ancistrocerus belizensis Cameron.[73] Type locality: Belize, British Honduras.

Odynerus (*Ancistrocerus*) *bravo* H. de Saussure.[74] Type locality: Tampico, Mexico. Specimens from New Mexico thus labeled in the Academy of Natural Sciences of Philadelphia, belong to *Parancistrocerus*.

Odynerus (*Ancistrocerus*) *bustamente* H. de Saussure.[75] Type locality: Perote, Mexico. Corrected to *Ancistrocerus bustamenti* by H. de Saussure in 1875.[76]

Odynerus (*Ancistrocerus*) *cervus* H. de Saussure.[77] Type locality: Canada. Type probably in de Saussure's collection at the Natural History Museum of Geneva. This was positively synonymized by de Saussure[78] with *A. tigris*. From the statement in the brief original description that the angles of the propodeum are more distinct than in *A. capra*, it would rather seem that it was based upon a specimen of *catskillensis*.

Odynerus cingulatus Cresson.[79] Type locality: Cuba. Type in the Gundlach Collection at the "Instituto de Segunda Enseñanza de la Habana," Havana, Cuba. This is a true *Ancistrocerus* "with a transverse carina anteriorly on the verge of the truncation" of the first tergite. A male, named by Cresson, was examined at the Academy of Natural Sciences of Philadelphia.

Ancistrocerus cockerelli Cameron.[80] Type locality: Ormsby Co., Nevada.

Ancistrocerus conspicuus H. de Saussure.[81] Type locality: Cordova, Mexico. Type probably in de Saussure's collection at

[72] Trans. Kansas Ac. Sci., XXII, 1909, p. 286.
[73] Trans. Amer. Ent. Soc., XXXIV, 1908, p. 230 (♂).
[74] Rev. Mag. Zool., (2), IX, 1857, p. 274 (no sex).
[75] Rev. Mag. Zool., (2), IX, 1857, p. 273 (no sex).
[76] Syn. Amer. Wasps, p. 172.
[77] Rev. Mag. Zool., (2), X, 1858, p. 165 (no sex).
[78] Syn. Amer. Wasps, 1875, p. 160.
[79] Proc. Ent. Soc. Philadelphia, IV, 1865, p. 162 (♀).
[80] Trans. Amer. Ent. Soc., XXXIV, 1908, p. 220 (♀).
[81] Synopsis of American Wasps, 1875, p. 177 (♀).

the Natural History Museum of Geneva. H. de Saussure gives a reference to the Revue et Magasin de Zoologie,[82] but I have not found the description of *A. conspicuus* in that paper.

Odynerus dejectus Cresson.[83] Type locality: Cuba. The type is in the Gundlach Collection at Havana. The species is closely allied to *O. bacu* and should also be placed in *Parancistrocerus*. Cresson states that the first tergite possesses "a faint transverse suture at base."

Ancistrocerus durangoensis Cameron.[84] Type locality: Durango, Colorado.

Odynerus (*Ancistrocerus*) *farias* H. de Saussure.[85] Type locality: Tampico, Mexico. Type and allotype probably in de Saussure's collection at the Natural History Museum of Geneva. The name was later corrected to *Ancistrocerus fariasi*.[86] I have taken both sexes of this species at Corocito and Prieta, Honduras, and have also seen it from Los Amates, Guatemala.

Ancistrocerus foxeanus Cameron.[87] Type locality: Sunbury, Pennsylvania. If this was correctly placed as to the genus, it must have been a *Parancistrocerus* closely allied to, if not identical with, *A. saecularis*.

Ancistrocerus fulvicarpus Cameron.[88] Type locality: southwestern Colorado.

Ancistrocerus fulvitarsis Cameron.[89] Type locality: Santa Clara Co., California. A true *Ancistrocerus*, according to the type at Pomona College.

Ancistrocerus gunnisonensis Cameron.[90] Type locality: Gunnison, Colorado. The name is misspelled *gunnistonensis* by Cameron in 1908,[91] where he claims that it belongs to the group of *O. anormis* Saussure, a species not included in *Ancistrocerus*.

Odynerus (*Ancistrocerus*) *guzmani* H. de Saussure.[92] Type

[82] (2), IX, 1857, p. 247.
[83] Proc. Ent. Soc. Philadelphia, IV, 1865, p. 164 (♀).
[84] Trans. Amer. Ent. Soc., XXXIV, 1908, p. 216 (♂).
[85] Rev. Mag. Zool., (2), IX, 1857, p. 274 (no sex).
[86] De Saussure, Syn. Amer. Wasps, 1875, p. 195.
[87] Trans. Amer. Ent. Soc., XXXII, 1906, p. 333 (♂).
[88] Trans. Amer. Ent. Soc., XXXIV, 1908, p. 222 (♀).
[89] Trans. Amer. Ent. Soc., XXXIV, 1908, p. 205 (♀ ♂).
[90] Invertebrata Pacifica, I, 1906, p. 146 (♂).
[91] Trans. Amer. Ent. Soc., XXXIV, p. 213.
[92] Rev. Mag. Zool., (2), IX, 1857, p. 275 (no sex).

locality: Mextitlan, Mexico. Type and allotype probably in de Saussure's collection at the Natural History Museum of Geneva.

Ancistrocerus halophila Viereck.[93] Type locality: San Pedro, California. Type at the Academy of Natural Sciences, Philadelphia. The author states that it is near *sulphureus* Saussure; but it is a true *Ancistrocerus*, as shown by the type, and is related to *A. catskillensis*.

Ancistrocerus howardi Cameron.[94] Type locality: Lee Co., Texas.

Odynerus (*Ancistrocerus*) *incommodus* H. de Saussure.[95] Type locality: Colombia. Type probably at the Paris Museum. This species was recorded from Cuba by Guérin-Méneville.[96]

Odynerus (*Stenancistrocerus*) *iolans* Cameron.[97] Type locality: Mexico.

Odynerus (*Ancistrocerus*) *lacunus* Fox.[98] Type locality: José del Cabo, Lower California. The holotype and allotype are probably no longer in existence. At the Academy of Natural Sciences of Philadelphia, there are three specimens labeled "type," which are probably cotypes. This is a *Parancistrocerus*.

Ancistrocerus lecontei Cameron.[99] Type locality: Ormsby Co., Nevada.

Ancistrocerus leensis Cameron.[100] Type locality: Lee Co., Texas.

Ancistrocerus lindemanni Cameron.[101] Type locality: Lee Co., Texas.

Ancistrocerus lineativentris Cameron.[102] Type locality: mountains near Claremont, California.

Ancistrocerus managuaensis Cameron.[103] Type locality: Managua, Nicaragua.

Odynerus (*Ancistrocerus*) *minnesotaensis* Cameron.[104] Type locality: Minnesota.

[93] Proc. Ac. Nat. Sci. Philadelphia, LIV, 1902, p. 735 (♂).
[94] Pomona Journ. Entom., I, 1909, p. 78 (♀).
[95] Et. Fam. Vesp., I, 1852, p. 143 (♂).
[96] In Sagra, Hist. Fis. Cuba, VII, 1856, p. 769.
[97] Trans. Amer. Ent. Soc., XXXI, 1905, p. 389 (♀).
[98] Proc. California Ac. Sci., (2), IV, 1894, p. 111 (♀ ♂).
[99] Trans. Amer. Ent. Soc., XXXIV, 1908, p. 218 (♀ ♂).
[100] Trans. Amer. Ent. Soc., XXXIV, 1908, p. 215 (♂).
[101] Trans. Amer. Ent. Soc., XXXIV, 1908, p. 219 (♂).
[102] Invertebrata Pacifica, I, 1906, p. 146 (♂).
[103] Invertebrata Pacifica, I, 1906, p. 145 (♀).
[104] Trans. Amer. Ent. Soc., XXXIV, 1908, p. 231 (♂).

Ancistrocerus nearcticus Cameron.[105] Type locality: Wilmerding, Pennsylvania. The description fits quite well certain males of *A. tigris* and I suspect it is identical with that species.

Ancistrocerus (?) *nigro-hirsutus* Cameron.[106] Type locality: Boulder, Colorado. A female, which is perhaps the type of this species, is in the collection of Pomona College labeled "*Odynerus nigrohirsutulus* Cameron"; it is a true *Ancistrocerus*, agreeing in every respect with *A. tuberculocephalus* (Saussure) and I regard it as a synonym of that species. There is also a male under the same name (not described by Cameron), which, however, is not an *Ancistrocerus*.

Odynerus (*Ancistrocerus*) *occidentalis* H. de Saussure.[107] Type locality: Sonora, Mexico. Type (♂) probably in de Saussure's collection at the Natural History Museum of Geneva.

Ancistrocerus ormsbyensis Cameron.[108] Type locality: Ormsby Co., Nevada. The type, which I have seen in the collection of Pomona College, is an *Ancistrocerus*, proper.

Odynerus packardi Cameron.[109] Type locality: northern Mexico. This is said to be a *Stenancistrocerus*.

Odynerus (*Ancistrocerus*) *parredes* H. de Saussure.[110] Type locality: Mextitlan, Mexico. In 1875,[111] de Saussure corrects the name to *Ancistrocerus parredesi*.

Ancistrocerus parvispinosus Cameron.[112] Type locality: Santa Fé district, New Mexico.

Odynerus (*Ancistrocerus*) *pertinax* H. de Saussure.[113] Type locality: New York State. Type presumably at the British Museum. Doubtfully synonymized with *A. tigris* by de Saussure.[114]

Odynerus (*Ancistrocerus*) *philetas* Cameron.[115] Type locality: Fedor, Texas.

[105] Trans. Amer. Ent. Soc., XXXII, 1906, p. 332 (♂).
[106] Trans. Amer. Ent. Soc., XXXIV, 1908, p. 203 (♀).
[107] Rev. Mag. Zool., (2), IX, 1857, p. 274 (no sex).
[108] Invertebrata Pacifica, I, 1905, p. 120 (♂).
[109] Trans. Amer. Ent. Soc., XXXII, 1906, p. 335 (♀).
[110] Rev. Mag. Zool., (2), IX, 1857, p. 273 (no sex).
[111] Syn. Amer. Wasps, p. 180.
[112] Trans. Amer. Ent. Soc., XXXII, 1906, p. 332 (♀).
[113] Et. Fam. Vesp., III, 1856, p. 216 (♂).
[114] Syn. Amer. Wasps, 1875, p. 160.
[115] Trans. Amer. Ent. Soc., XXXIV, 1908, p. 214 (♀).

Ancistrocerus (*Nortonia ?*) *phoenixensis* Cameron.[116] Type locality: Phoenix, Arizona.

Odynerus pictiventris Cameron.[117] Type locality: New Mexico. This is possibly an *Ancistrocerus*.

Odynerus piloscllus Cameron.[118] Type locality: Costa Rica. "First abdominal segment cup-shaped, the top of the basal slope with a not very distinct ridge."

Ancistrocerus quebecensis Cameron.[119] Type locality: Montreal, Canada. This I regard as probably identical with *A. tigris*.

Ancistrocerus rivularis Cameron.[120] Type locality: Three Rivers, California.

Odynerus (*Ancistrocerus*) *santa-anna* H. de Saussure.[121] Type locality: Mexico. The types (♀ ♂) are probably in de Saussure's collection at the Natural History Museum of Geneva. The name was corrected to *Ancistrocerus santa-annae* by de Saussure.[122]

Ancistrocerus sayi Cameron.[123] Described from North America, without locality.

Ancistrocerus sexcingulatus Ashmead.[124] Type locality: New Mexico. The type is in the United States National Museum. Dalla Torre[125] wrongly credits the species to Cockerell. Ashmead's brief description applies quite well to the male of *A. tigris*. I have seen a series of males from Fargo, North Dakota (O. A. Stevens); Beaver Valley, Utah (G. P. Engelhardt); and Jemez Springs, New Mexico (John Woodgate), which evidently are *sexcingulatus* and some of which had been identified as that species, in one case by Ashmead himself. The only difference I can discover with *A. tigris* is that the clypeus is somewhat more deeply emarginate in *sexcingulatus*. Unless the unknown female shows better characters, *sexcingulatus* will eventually be united with *tigris*.

[116] Trans. Amer. Ent. Soc., XXXIV, 1908, p. 225 (♀ ♂).
[117] Trans. Amer. Ent. Soc., XXXII, 1906, p. 331 (♀).
[118] Timehri, Journ. Agric. Soc. Brit. Guiana, (3), II, 1912, p. 221 (♀).
[119] Trans. Amer. Ent. Soc., XXXII, 1906, p. 333 (♂).
[120] Trans. Amer. Ent. Soc., XXXIV, 1908, p. 215 (♂).
[121] Rev. Mag. Zool., (2), IX, 1857, p. 273 (no sex).
[122] Syn. Amer. Wasps, 1875, p. 171.
[123] Trans. Amer. Ent. Soc., XXXIV, 1908, p. 221 (♂).
[124] Psyche, IX, 1901, p. 185 (♂).
[125] Gen. Insect., Vesp., 1904, p. 54.

Ancistrocerus simulator Cameron.[126] Type locality: Ormsby Co., Nevada.

Ancistrocerus spilogaster Cameron.[127] No locality given; probably from either California or Nevada. The type, at Pomona College, is a true *Ancistrocerus*.

Odynerus (*Ancistrocerus*) *sumichrasti* H. de Saussure.[128] Type locality: Cuernavaca, Mexico. The type (♀) is probably in de Saussure's collection at the Natural History Museum of Geneva.

Ancistrocerus tenuatus Tucker.[129] Type locality: Denver, Colorado. The description agrees quite well with *A. tigris*, except for the presence of a yellow "apical spot on upper side of apex" of the abdomen. It is possible that this is the female of *A. sexcingulatus* Ashmead.

Ancistrocerus trichionotus Cameron.[130] Type locality: Stanford University, California. A true *Ancistrocerus*, according to the type at Pomona College.

Ancistrocerus truncatus Cameron.[131] Type locality: Berkeley, Colorado.

Ancistrocerus variornatus Cameron.[132] Type locality: vicinity of Havana, Cuba. The type is in the collections of Pomona College.

Ancistrocerus ventones Cameron.[133] Type locality: Fedor, Texas.

Cameron[134] has transferred *Odynerus fundatus* Cresson[135] to *Ancistrocerus;* but that species is a *Stenodynerus*, as there is not the slightest trace of a transverse carina on the first tergite either in the type, which I have seen at the Academy of Natural Sciences of Philadelphia, or in a paratype at the Museum of Comparative Zoölogy. Robertson's interpretation of the species appears correct.

[126] Trans. Amer. Ent. Soc., xxxiv, 1908, p. 222 (♀).
[127] Invertebrata Pacifica, i, 1905, p. 121 (♂).
[128] Rev. Mag. Zool., (2), ix, 1857, p. 275 (no sex).
[129] Trans. Kansas Ac. Sci., xxii, 1909, p. 286 (♀).
[130] Invertebrata Pacifica, i, 1905, pp. 120 and 121 (♂).
[131] Trans. Amer. Ent. Soc., xxxiv, 1908, p. 217 (♀).
[132] Algunos Himenópteros collec. por el Prof. Baker en Cuba, (date ?), p. 9 (♂).
[133] Trans. Amer. Ent. Soc., xxxiv, 1908, p. 209 (♂).
[134] Trans. Amer. Ent. Soc., xxxiv, 1908, p. 209.
[135] Trans. Amer. Ent. Soc., iv, 1872, p. 242 (♀ ♂); Bosque Co. and Dallas Co., Texas.

The following should also be eliminated from *Ancistrocerus:*

Ancistrocerus antheus Cameron.[136] Type locality: Ormsby Co., Nevada. According to the type at Pomona College, this is not an *Ancistrocerus.*

Odynerus (*Stenodynerus*) *claremontensis* Cameron.[137] Type locality: Claremont, California. Cameron transferred it to *Ancistrocerus* in 1908,[138] but from an examination of the type at Pomona College it is a true *Odynerus.*

Odynerus colon Cresson.[139] Type locality: Bosque Co., Texas. The type (♀), which I have examined at the Academy of Natural Sciences of Philadelphia, shows that this is a *Stenodynerus,* and that Cameron's identification was erroneous, when he transferred the species to *Ancistrocerus.*[140]

Nortonia nevadaensis Cameron.[141] Type locality: Ormsby Co., Nevada. This is said to have a transverse carina on the first tergite and, according to the type at Pomona College, is a *Symmorphus.*

Odynerus obliquus Cresson.[142] Type locality: Cuba. The type, at the Academy of Natural Sciences of Philadelphia, possesses a strong, transverse carina on the first tergite; but this first tergite is so much narrower than the second, that the species should be properly placed in *Nortonia.*

Ancistrocerus pelias Cameron.[143] Type locality: Ormsby Co., Nevada. Misspelled *A. pilias* by Cameron.[144] According to the type at Pomona College, this is not an *Ancistrocerus.*

Ancistrocerus satyrus Cameron.[145] Type locality: Ormsby Co., Nevada. According to the type at Pomona College, this is not an *Ancistrocerus.*

Ancistrocerus tityrus Cameron.[146] Type locality: Ormsby Co., Nevada. According to the type at Pomona College, this is not an *Ancistrocerus.*

[136] Trans. Amer. Ent. Soc., xxxiv, 1908, p. 210 (♂).
[137] Invertebrata Pacifica, i, 1905, p. 122 (♀).
[138] Trans. Amer. Ent. Soc., xxxiv, p. 205.
[139] Trans. Amer. Ent. Soc., iv, 1872, p. 241 (♀ ♂).
[140] Trans. Amer. Ent. Soc., xxxiv, 1908, p. 206.
[141] Invertebrata Pacifica, i, 1905, p. 124 (♂).
[142] Proc. Ent. Soc. Philadelphia, iv, 1865, p. 163 (♀ ♂).
[143] Trans. Amer. Ent. Soc., xxxiv, 1908, p. 208 (♀).
[144] Pomona Journ. Entom., i, 1909, p. 78.
[145] Trans. Amer. Ent. Soc., xxxiv, 1908, p. 211 (no sex).
[146] Trans. Amer. Ent. Soc., xxxiv, 1908, p. 211 (♀).

A REVIEW OF THE GENUS LEPIDOPHORA (DIPTERA, BOMBYLIIDAE)

BY R. H. PAINTER

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The rediscovery of *Lepidophora appendiculata* Macquart in the state from which the type came, has been made the starting point for a review and a redescription of most of the species of this interesting genus. The collection of a single species of *vetusta* Walker, taken at Harlingen, Texas, gives us three species of the genus in the United States. Professor Jas. S. Hine has loaned me a South American specimen which proves to be *secutor* Walker. These together with our more common *lepidocera* Wiedemann, are redescribed and some notes given on their occurrence. This leaves only *culiciformis* Walker, which has not been recorded again since it was first described. The original description is reproduced below in order to make it more readily accessible than the original source.

Kertesz in his "Catalogus Dipterorum" has incorrectly referred *Lepidanthrax* (*Anthrax*) *campestris* Coquillett to *Lepidophora*, apparently without comment. I have seen the type in the United States National Museum; it is a true *Lepidanthrax* and these genera are quite distinct.

I am indebted to Professor Hine for the use of specimens in the Ohio State University Collection and to Dr. J. M. Aldrich of the United States National Museum for specimens for study and comparison. The localities from which these species were taken are given below.

Genus **LEPIDOPHORA**

Westwood, Lond. Edinb. Philos. Mag., 6, p. 447, 1834.
Osten Sacken, Biol. Cent.-Amer., Dipt., 1, p. 160. (Table of species.)

Genotype: *Toxophora lepidocera* Wiedemann.[1]

Redescription: Head smaller than thorax, subglobular, placed low on the thorax. Proboscis long; antennae very long, prominent, approximate at the base, situated on a protuberance;

[1] Auss. Zw., 1, 360, pl. v, f. 4.

first joint cylindrical, longer than second and third together; second and third joints about equal, the former cylindrical, the latter bluntly conical, all joints clothed with scales, those of the third not on all parts of the segment. Eyes not contiguous in either sex, the distance between them more than twice as wide in the female than in the male; three ocelli. Pronotum prominent, separated by a deep suture from the large mesonotum, which is extremely arched. Scutellum a little broader than long. Abdomen narrower than thorax, elongate, arched downwards. Entire body clothed more with long scales than hairs. Legs long, bristly, scale covered. Wings with scattered scales above and below, especially along the anterior border. The bifurcation of R_{2+3} and R_{1+5} takes place at an acute angle and at a considerable distance from the r-m crossvein. Cells R_5, M_1, second M_2, and Cu_1 present, cells R_5 and Cu_2 open.

Range: North and South America. Life History, unknown.

These are moderately large flies conspicuously covered with long scales and with a peculiar hump-backed appearance. Spurious veins and extra cells are often present, sometimes only in one wing and absent in the other. On the sides of each abdominal segment in all of the species I have seen there are two small oval shining spots, which look like spiracles. The opening for the male genitalia at the end of the abdomen is round, that for the female often laterally compressed, the tuft of scales at the tip of the abdomen takes these forms also.

Table of Species

1. Wings entirely dusky, scales on third antennal joint short..2
   Wings with tip and posterior margin hyaline or brown hyaline; scales on third antennal joint long.....3
2. Scales on prothorax and pleura white; few or no light colored scales on the fourth segment.....*appendiculata* Macquart
   Scales on prothorax and pleura yellow; a large patch of yellow scales on the fourth abdominal segment.
   lepidocera Wiedemann
3. Long scales of third antennal joint occupy only the basal two-thirds of that joint; scales and hairs on pleura white or blackish-brown.....*vetusta* Walker
   Third antennal joint clothed with long scales on one side from base to tip; scales surpassing the tip of that joint; scales and hairs on pleura black; abdomen of male clavate.
   secutor Walker

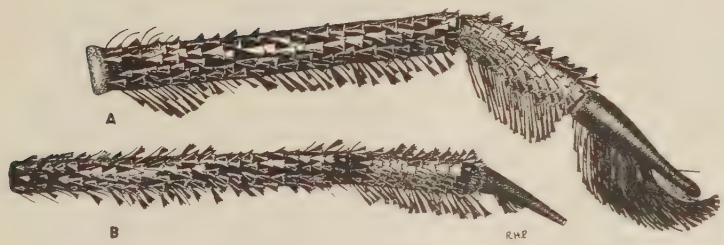


Fig. 1. Antennae of *Lepidophora;* (A.) *L. secutor* Walker, (B.) *L. lepidocera* Wiedemann.

Lepidophora appendiculata Macquart

Macquart, Dipt. Exotiques, Suppl., 1, p. 118 (*Toxophora*).
Osten Sacken, Biol. Cent.-Amer., Dipt., 1, p. 160. (Key only.)

Length, 15 to 20 mm. (measuring curve formed by body and including antennae); wings, each, 9 to 12 mm.

♂ ♀. Ground color of body dark grayish black, with anterior dorsal angles of thorax reddish; with black and white hairs and scales and white curly hair. Thorax with a median stripe of black scales. Wings blackish, lighter along posterior border; sometimes entirely somewhat lighter colored with veins fuscous. Legs and antennae variable in color from black to reddish. Abdomen with a patch of white scales on each side of segments one, two, three and five, otherwise with black scales.

Head black, proboscis variable in length, occiput with white and black scales and black spines; below with long sparse white hairs. Oral cavity on sides with thin black hairs, above with long black scales. A patch of white scales on either side of antennae above. Antennae vary from black to red, with black scales on first and second segments which in certain lights show glossy and shining; third segment with a few small scales in a row on the outer side. Prothorax large, bead-like, forming a neck, covered with white hair-like scales and black bristles above, on the sides and below with brownish scales. Mesothorax, ground color blackish with a red spot on the anterior and posterior dorsal angles. Entire thorax clothed laterally and ventrally with white curly or scale-like hairs and a very few black scales. On the dorsum with white scales except a median stripe of black ones; suture between mesonotum and scutellum with white scales and a few black ones occasionally present. Scutellum with black scales on top, but white scales around the

edges. All bristles black. Abdomen blackish brown, posterior margins of segments slightly more brownish; clothed with black scales except for the white ones on the sides of segments one, two, three and five. A few brownish ones occasionally at the tip of the abdomen. Legs black to reddish, thickly covered with black scales which are very glossy; femora white scaled below, the coxae with white hairs. Wings brownish black, lighter along the posterior border; sometimes entirely light with veins fuscous; the course and curves of the veins quite variable. Small black, glossy scales along the anterior edge on both sides of the wing in cells C., Sc., R., second M, and in the bases of cells R_1, R_3, first M_2, and Cu_2. Cell R_4 with veins bounding it curved forward, a stump of a vein on the anterior angle of vein R_4 present in some specimens, absent in others. Halteres white with white scales. The male is usually lighter in color than the female.

Redescribed from a male and two females in my collection. Taken near Brownwood, Texas (center of the State), on the flowers of *Cissus incisa* Desmoul, August 14, 1921. Also a male from Mt. Pleasant, Iowa, which is somewhat larger. In the Ohio University Collection there are three males, two from Billy's Island, Okefenokee Swamp, Georgia, taken in June and one from the edge of the same Swamp, taken in August; also two males from College Station, Texas, secured in October and November.

These specimens agree with Macquart's description in every detail. There is some variation in the color of the lighter scales and very rarely there are some of these on the fourth segment. The species is quite close to *lepidocera* and perhaps more collecting will show that the species intergrade. However, they may be distinguished from *lepidocera* by the larger size, lighter ground color and generally white (instead of yellow) scales, especially on the prothorax and pleura. *Appendiculata* usually has the scales on segment four of the abdomen entirely black. I have seen one specimen with a few white ones there. A stump of a vein on R_4 is present in some specimens of both species but not in all. This character was one of those used by Osten Sacken and Macquart in separating the two species.

Lepidophora lepidocera Wiedemann

Wiedemann, Auss. Zw., I, p. 360, pl. v, f. 4 (*Toxophora*).
Westwood, Lond. and Edinb. Philos. Mag., 1835, VI, p. 447. (*L. aegeriiformis.*)

Length, 12 to 16 mm.; wings each, 8 to 11 mm.

Body black, covered with black and yellow scales and hairs. Wings black, slightly lighter in color along the posterior border, with sparse black glossy scales on the cells of the anterior border, on both sides of the wing. Abdomen black with patches of yellow scales on the sides of the first five segments.

Antennae black, first two joints covered by black scales and spines, third joint with short spines at the base and a few small scales on the outer side. Proboscis blackish, length variable; face black; a few sparse black hairs at the sides of the oral cavity and black scales above. On each side of the base of the antennae a patch of white scales; on the antennal prominence, above, a few black hairs. Occiput black with long yellow scales and black spines, small scales near the orbit; below, more reddish with white hairs and brown scales. Prothorax black with black spines and long yellow scales. Mesothorax black with black spines; the dorsal borders somewhat reddish. Dorsum with small sparse yellow and black scales; the exact pattern seems variable. Pleura with long white and yellow curly hair-like scales. Scutellum black, in the center with black scales, edges with yellow ones. Abdomen black with black scales and hairs, except for a patch of yellow scales on the sides of the first five segments, a few on the dorsum of the first two segments and a few in the caudal tuft of scales, yellow. This tuft consists mostly of long black scales on the last three segments of the abdomen. Venter with black glossy scales, a few white scales and hairs on the first two segments beneath. The yellow scales extend onto the dorsum of segments one and two. Legs black with black scales and spines; lower side of the femora with white scales. Wings blackish brown, posterior border lighter, course and curves of veins variable; anterior border of wings scale-covered on both sides of the wings. Halteres yellow with white scales on the stalk.

Redescribed from three male specimens taken at Whitings, New Jersey (August), in my collection. In the Ohio State University Collection there is a female from Bluffton, Indiana, taken in September; two males from Big Pine Creek, Hocking Co., Ohio, secured in August; one male from Ira, Ohio, and one female from Fort Wayne, Indiana, taken in September.

Lepidophora vetusta Walker

Walker, Trans. Ent. Soc. London, n. ser., IV, p. 145, (1857).
Osten Sacken, Biologia Cent.-Amer., Dipt., I, p. 160.
Williston, Biol. Cent.-Amer., Dipt., Suppl., p. 240.

Length, 18 mm. (measuring curve formed by body); wings each, 11 mm.

Ground color more brownish than in the other species; dorsum of thorax black except around the edges, which are reddish brown. Scales and hair various in color; patches of white scales along the sides of first, second, third and dorsum of sixth segment. Abdomen cylindrical. Third segment of antennae with a tuft of scales above, confined to the proximal two-thirds of the segment. Wings black, hyaline at tip and along posterior margin; outline of brown fairly distinct.

Head gray black. Base of first and second joint of antennae reddish, remainder black, first and second joints covered with black scales. Third joint with a conspicuous tuft of black scales, above. Proboscis as long as the first two joints of antennae or shorter. Oral cavity on sides fringed with long sparse black hairs; above the proboscis with black scales. Vertex and front with black and yellow scales and black hairs. Occiput above with dirty yellow scales and stiff black hairs; on the sides these become brownish and below only sparse black hairs. Prothorax black with long white or tan scales and stiff black bristles. Ground color of mesothorax brownish gray; the edges of the mesonotum red, the dorsum blackish, a black spot on the mesopleura. Clothed laterally with long white scales and hairs and thin black bristles. These scales are sometimes purplish. Mesonotum with a very narrow median stripe and two wider lateral ones of white scales; separated by black ones. Scutellum red with yellowish white scales. All thoracic bristles black. Abdomen, ground color, black above, lighter beneath; apices of segments and all of seventh segment generally reddish brown. Clothed above with black scales, below with pale brown or black ones. These brown scales, when present, extend over dorsum of first segment. A patch of white scales on sides of first, second, third and fourth segments and a similar patch on the dorsum of the sixth. Tip of abdomen thickly plumed with black scales which are sometimes pedunculated. Legs reddish brown with pale brown scales and black bristles; coxae with long brown hairs. Wings black with the apex and posterior border hyaline; a few scattered black scales along anterior border. The following cells partly hyaline; expanded part of R_1, and R_3, all of R_4, distal half of R_5, all except the base of M_1, M_2, Cu_1, and Cu_2. Veins along the posterior border very lightly fuscous. Halteres brown with white knob and white scales on the stalk.

Redescribed from a male specimen taken by Mr. F. M. Hull at Harlingen, Texas (near Brownsville), August 4; and from specimens from the United States National Museum from Higuito, San Mateo, Costa Rica; Presidio River, Mexico; Sinaloa, Mexico and Tehuantepec, Mexico. There are three male speci-

mens in Prof. Hines' collection from San José, Guatemala, February 5; and Gualan, Guatemala, January 22.

The females in the series are generally darker in color, have the expanded part of cell R and the veins of the tip of the wing clouded with brown, while in the males this part is usually clear hyaline. The white scales on the abdomen vary in extent; sometimes there is an extra patch on the dorsum of segment four and also five. The black scales in both sexes often show an opalescent reflection of green or violet.

Osten Sacken has doubtfully recorded this species from Mexico and Guatemala; and Williston from Vera Cruz, Mexico. Walker's specimen, a male, came from the Amazon Valley.

An interesting aberration is a spurious vein in the Texas specimen which goes from the costa through the tip of cell R_1, crossing into R_3, and found in both wings. This specimen was taken while it was hovering over a bare sandy spot among mesquite and cacti.

Lepidophora species

I have a specimen of what may be another species, from Harlingen, Texas (F. M. Hull), which is too badly broken to name. It is less than half the size of *vetusta* and has the third antennal joint with a tuft of scales above, confined to the proximal half of that segment; wings with hyaline tip and posterior border less brown, the distal end of R_{2+3} fuscous, two stumps of veins in cell R_3, few or no black scales on the thorax, the general ground color dark brown. The abdomen is missing.

Lepidophora secutor Walker

Walker, Trans. Entom. Soc. London. n. ser. iv, p. 145, (1857).

Length, 23 mm. (measuring curve of body); wings, each 11 mm.

♂. Ground color black, posterior callosities and posterior margins of abdominal segments reddish; pleura and venter of thorax grayish black; abdomen clavate. Legs very dark reddish brown to black. Scales and hairs mostly black with purplish reflections. Small patches of white scales on the sides of segments one, two, three and four. Third joint of antennae with a tuft of scales on the outer side above, which extends practically the entire length of the segment, and surpasses it in length. Wings black along the anterior margin, brown hyaline at the tip and along the posterior margin.

Head black; antennae black, first two joints covered by long black scales, third with several conspicuous rows of long black scales along the outer side, above. Two short bristles near the tip on the inner side. Oral cavity, fringed with long hairs above with long black scales. Vertex with black scales and hairs. Occiput and prothorax with spines; and a few long white scales. Dorsum of thorax and pleura covered with sparse curly white scales and longer black hairs; both longer still on the pleura and margin of the scutellum. Disk of scutellum with black and whitish scales, margins behind with golden yellow ones. Abdomen somewhat clavate, clothed with black scales, sides of the first four segments with whitish scales; long sparse brown hair on the sides of segment one and the venter of the first four. Posterior lateral borders of the last four segments clothed with conspicuous long black scales, directed caudad. Legs blackish brown covered with black scales. Wings with a black anterior border which gradually fades into a brown hyaline at the tip beyond the end of vein R_{2+3}, and along the posterior border. Scales along the anterior border rather few, confined to cells Sc, R_1, R, M, and Cu_2.

Redescribed from a male specimen from Bartica, British Guiana, May 2, (Parish), in the collection of Prof. Hine; and a male from Pebas, Amazon River, Peru, in the collection of the United States National Museum (Coquillett Collection).

Presumably these specimens are Walker's species, although it would be impossible to tell positively without comparing with the type. The specimens fit Walker's description, such as it is. The type was collected in the Valley of the Amazon.

Lepidophora culiciformis Walker

I am indebted to Dr. C. W. Johnson of the Boston Society of Natural History for the following copy of the description of *Lepidophora culiciformis* Walker:[2]

"Nigra, hirta, abdominalis apice pilis piceis ornato, antennis pedibusque nigris, alis nigro-cinereis basi et ad costam nigro-fucis.

"Body quite black, clothed with black hairs; eyes pitchy, parted above by a moderate interval; all the facets very small; feelers nearly as long as the chest; neck and sides of the chest beset with black bristles; tip of the abdomen feathered on each side with pitchy plumes; legs black, beset with black bristles; wings dark gray, dark brown at the base and between the fore

[2] Newman's Zoology, 8, append. pp. xcvii.

border and the disk till near the tips; wing-ribs and veins black; poisers black, with white tips. Length of the body 6 lines; of the wings, 10 lines. Para."

A NEW GENUS AND SPECIES OF APHELINIDAE (HYMENOPTERA) FROM CHINA[1]

BY HAROLD COMPERE

PARAPHYTIS new genus

The female of this form is not easily separated from *Aphytis* and *Marietta*, to which it is very closely allied, possessing characters common to both genera. *Aphytis* and *Marietta* are quite similar and it was at first supposed that the genus here described as new was but an annectant species. In the collection of the Citrus Experiment Station there is an undescribed form from Cape Town, Union of South Africa, that has a maculated body comparable to typical *Marietta*, but with hyaline wings and venation typical of *Aphytis*. In Timberlake's collection is an Australian species with a body like *Aphytis* and maculated wings similar to *Marietta*. *Marietta* has been previously distinguished from *Aphytis* by the possession of the so-called acutely triangular mesopostscutellum and the irregular pattern of the cilia and maculations which mark the forewings. The specimens studied seem to intergrade to a great extent. The so-called mesopostscutellum proves to be a backward-projecting median salient of the propodeum, which in *Marietta* is well developed and prominent, appearing in the tag-mounted specimens not unlike a separate acutely triangular sclerite. In typical *Aphytis* the propodeum is longer, of more uniform length and without the coarsely sculptured median salient. Before the discovery of the male form of *Paraphytis* the females could not be satisfactorily assigned to either *Aphytis* or *Marietta* on the basis of any characters known to me, it seeming to be intermediate. The principal character used in the erection of the new genus is possessed by the male, the antennae being only five-jointed, in this respect differing from any species of *Aphytis* or *Marietta* so far discovered. The females can be readily distinguished from any described *Aphytis* or *Marietta* by the peculiar dark-brown vittate markings on the thorax.

[1] Paper No. 125, University of California, Graduate School of Tropical Agriculture and Citrus Experiment Station.

The Female

Antennae six-jointed; maxillary palpi two-jointed, labial palpi one-jointed; mandibles with two acute teeth and a broad dorsal margin or truncature; antennae apparently inserted higher above the oral margin than in *Aphytis*, the exact distance not obtainable from the specimens studied; mesoscutum and scutellum with conspicuous longitudinal dark-brown stripes; metanotum of uniform length, on the meson conspicuously sculptured and infuscated, the sides gradually expanding longitudinally without visible sculpture; the shortest length of the propodeum almost if not actually thrice the length of the median longitudinal measurements of the metanotum; differing from typical *Aphytis* by the median prominent backward-projecting salient of the propodeum and from typical *Marietta* by the greater length of this sclerite; in other characters the thorax resembles typical *Aphytis;* abdomen as long as the thorax and almost as wide, either side of each tergite blotched with fuscous and clothed with comparatively strong black setae; ovipositor slightly exserted; forewings with a maculated pattern and a well defined speculum; submarginal vein slightly less than one-half as long as the marginal; postmarginal vein absent; stigmal vein short, the neck not constricted, rounded at apex; marginal cilia comparatively long on the distal posterior curvature; legs conspicuously blotched and banded with fuscous; first tarsal joint of the middle legs as long as the two following joints combined; spur of middle tibiae about as long as the metatarsus.

The Male

Antennae five-jointed, i. e., scape, pedicel, two funicle joints and solid club; thorax with the vittate markings and coarse sculpture, so prominent in the female, faint and partly obsolete; abdomen with two submedian fuscous blotches on the fifth tergite; first two tarsal joints of the middle legs black; fuscous bands on the legs almost obsolete; forewings hyaline, greatly resembling the wing of typical *Aphytis.*

Type of genus; *Paraphytis vittata* new species.

Paraphytis vittata new species (Pls. III and IV.)

The Female

Shape of head similar to *Aphytis;* ocelli in an acute triangle, the lateral pair their own diameter from the eye margins and three times this distance from the occipital margin; antennal scape, exclusive of the radicle joint, not quite as long as the

distal funicle joint and club combined, about five times as long as wide, in lateral view slightly arcuate, gradually increasing in thickness for three-fourths the length, being widest one-fourth the distance from the apex; pedicel slightly more than two-thirds as wide as long, a trifle wider than the scape; one false ring joint; the first funicle joint oblique; the ventral margin longer than the dorsal margin; the second funicle joint more symmetrical, the dorsal margin slightly longer than the ventral; first two funicle joints short, each about one and one-half times as wide as long; the third funicle joint about one-third as long as the club and as wide, the dorsal margin a shade longer than the ventral; club broadest at the base, gradually tapering to an acute point at the apex; the third funicle joint with one clear linear sensorium in lateral view, the club with five sensoria (fig. 1A). Sculpture of the dorsum of the thorax variable; the heavy reticulations occupy the infuscated areas, becoming evanescent on the light-colored portions; reticulated lines of the two submedian stripes of the mesoscutum are more transversely drawn out and do not anastomose to form as compact a network of cells or areoles as on other parts; areoles on the submedian stripes of the scutellum not so angular and broken as those of the mesoscutum but more evenly rounded and elongate; metanotum with a well marked but limited sculpture on the median infuscated area between the projection of the apical scutellar bristles; propodeum with a distinctive sculpture, pronounced posteriorly on the median salient where the infuscated stripes which arise from beneath the spiracles converge, the markings here appear in the nature of elongate apically rounded pigmented cells arranged in a scale-like formation; the following notal sclerite with a medium blotch, its cells flat and pigmented and placed like a pattern in a mosaic; in the tag-mounted specimens this area appears as a median infuscated blotch. Forewings a trifle more than two and one-half times as long as the greatest width; marginal vein slightly more than twice as long as the submarginal; postmarginal absent; stigmal vein short, subglobular, with four clear pustules crowded together; speculum strongly oblique, of uniform width, extending from immediately beneath the stigmal vein to the basal extremity of the thickened fold on the posterior margin of the wing; ciliation and infuscated pattern as shown in figure 1 B; the hyaline pattern as shown in the drawing fails to reveal the small transparent cilia which clothe these apparently naked spaces.

Eyes clothed with small stout black setae; frontovertex with four long setae on the occipital margin in addition to several slightly smaller ones; pronotum with three small setae in transverse alignment on either side of the meson, a much stronger seta on either posterior corner, in addition several small weak

setae on the anterior margin at the sides; mesoscutum with a row of four setae longitudinally aligned on the submedian stripes, another pair on either anterior lateral corner; parapsides each with two strong setae and a weak hair placed between; each axilla with one weak seta; scutellum with a discal and an apical pair of setae widely separated, these not much stronger than the larger ones on the other sclerites; abdominal tergites on either side with small stiff black setae; last two tergites with a complete row of hairs transversing the dorsum; the hairs on the pedicel and first two funicle joints of the antennae somewhat stronger than those on the other joints.

General color of the head and body light yellow, the frontovertex with a trace of orange; mandibles black; antennal scape pallid white with a trace of fuscous on the margin, first two funicle joints and club slightly but distinctly fuscous, pedicel and third funicle joint pallid; mesoscutum and scutellum with a submedian pair of longitudinal stripes and a stripe on either side, which on the scutellum merge into the submedian stripes on the posterior margin; on the meso-scutum the lateral and submedian stripes are not continuous posteriorly; metanotum with a median infuscation; propodeum with a transverse infuscation which arises under the spiracles and converges on the median salient; immediately posterior to the salient of the propodeum an infuscated blotch occurs on the second morphological abdominal segment; the so-called first abdominal segment with the posterior margin infuscated; abdominal segments from one to six with a transverse fuscous blotch on either side; the apical segment with the infuscation extending from under the cercal plates to the apex; in addition to the pronounced markings already mentioned, fainter or less extensive infuscations occur as follows: on anterior margin of the mesoscutum, sides of the parapsides, axillae and posterior portion of tegulae slightly suffused; pronotum with a median blotch above insertion of the neck; legs conspicuously banded or blotched with fuscous; all tibiae with two broad annuli or blotches more or less continuously encircling the legs; femora with a blotch on under side near apex; all tarsi faintly brownish yellow, the metatarsus of middle legs and empodia of all legs darker.

Length, 1.0 mm.

The Male

Differs from the female principally in antennal and wing characters and to a lesser extent in coloration and sculpture. Antennae differ from the female by having one less funicle joint; scape and pedicel somewhat similar to female; pedicel a shade longer than the second funicle joint and not quite as wide; first funicle joint a shade wider than long, asymmetrical, the ventral

margin slightly longer than the dorsal, the apical margin slightly oblique; second funicle joint more than twice as large as the first, more than one-third as long as the club and not quite so wide; club about two and one-half times as long as wide, slightly differently shaped from that of the female, more rounded at apex and slightly tapering at base (fig. 2 D). Forewings hyaline with a slight fuscous cloud under the junction of the submarginal with the marginal vein; submarginal vein more than one-half as long as the marginal; about nine rows of cilia basad of the speculum under the marginal vein, additional cilia scattered towards the root of the wing, these about twice as large as the cilia distad of the speculum; disk of wing uniformly ciliated; apical posterior curvature with a fringe of cilia about twice as long as the width of the speculum (fig. 2 E). Body considerably more yellowish than in the female, fuscous markings and coarsely sculptured areas so conspicuous in the female obsolete or partly so; differs from the female by having two dark-brown subdorsal blotches on the fifth abdominal tergite, and by having the two first tarsal joints of the middle legs black; first abdominal tergite transversely marked with fuscous, interrupted at the meson, not extending to the sides; legs more yellowish than in the female with fuscous bands wanting or only faintly indicated.

Length, 0.53 mm. to .75 mm.

Described from 5 females and 4 males (*holotype*, *allotype* and *paratypes*) found in debris in shipping box and also reared January 24, 1925, from *Lepidosaphes tubulorum* Ferris infesting an unknown plant received from F. Silvestri, who collected the coccids at Amoy, China. This material is now being imported by the University of California in an effort to secure primary parasites of the purple scale, *Lepidosaphes beckii* (Newm.). As yet, it has not been determined whether this is a primary or a hyperparasitic species.

Types to be deposited in the United States National Museum. Paratypic material placed in the collection of the Academy of Natural Sciences of Philadelphia.

Explanation of Plates

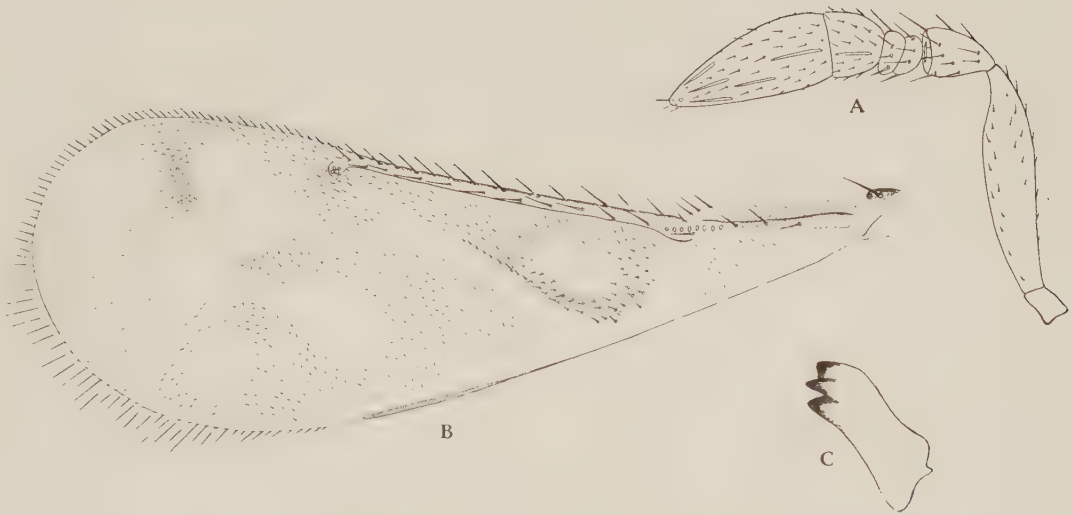
Paraphytis vittata new genus and new species

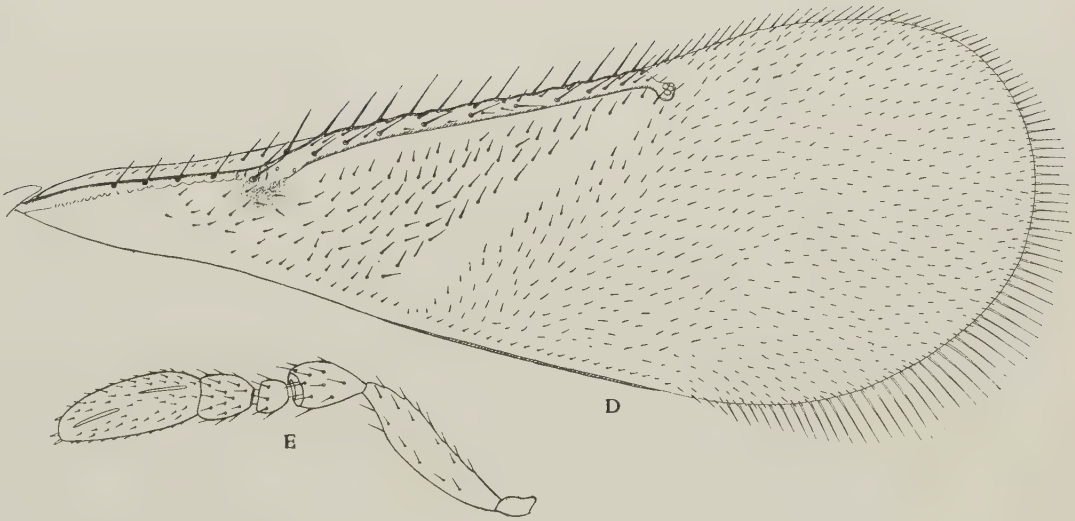
Plate III

Female: A, antenna; B, forewing; C, left mandible.

Plate IV

Male: D, forewing; E, antenna.


A
B
C



COMPERE—NEW APHELINIDAE FROM CHINA

A NEW BEE OF THE GENUS ANDRENA, IN THE COLLECTION OF THE ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA

BY HENRY L. VIERECK

Ottawa, Canada

Andrena (Andrena) stenosoma new species

Type.—No. 4130, The Academy of Natural Sciences of Philadelphia.

Type-locality.—Nevada, (H. K. Morrison).

Related to *A.* (*A.*) *moesticolor* V. & C.

Male. Length, 9 mm.; body black, mostly covered with ochreous hair; head with its facial line : transfacial line : : 46 : 57, axial line : temporal line : : 27 : 19, temples produced almost right angularly, the angle apparently opposite a point a little above the middle of eye, malar line : joint three of antennae : : 2 : 7, elevated portion of malar space down its middle barely defined but longer than the depressed portion, head covered with ochreous hairs except along the inner, outer and upper eye margin, and on most of the front, some hairs on lower part of front and most hairs on clypeus ochreous, front indistinctly sculptured, dullish, reticulated and longitudinally ribbed, ocellocular line : occelloccipital line : : 13 : 7, face shining, distinctly punctured, its punctures from one to three puncture widths apart and partly, nearly hidden by hairs, clypeus nearly convex, barely elevated above the apical margin, more shining and more distinctly punctured than the face, clypearea wanting, sculpture of the clypeus not hidden by the moustache, labrarea with a broad rounded emargination, polished, its width at base : greatest length : : 5 : 4, width at apex : length down the middle : : 3 : 4, labrarea at base : distance between lower corners of clypeus : : 5 : 11, labrum with a fringe of golden hairs, joint three of antennae : 4 : : 7 : 5, joint four and following joints from a little more than one and one-half times as long as thick to nearly as thick as long, dullish, flagel, almost straight in outline, antennae blackish brown throughout, mandibles nearly typical, rather slender, extending beyond the outer edge of the labrum and nearly to end of the basal third of their fellow, black except for the apical fourth which is dull dark reddish, palpi nearly typical; thorax with sparse ochreous hairs, hairs of dorsulum seemingly shorter than hairs of meso-

pleura, dorsulum dullish, finely reticulated and sparsely indistinctly punctured, mesopleura dullish with brownish and blackish hairs throughout, finely reticulated and with rather indistinct shallow pits, scutel hairy and sculptured like the dorsulum, metanotum hairy and sculptured like the dorsulum except that the sculpture is denser, tegulae dark brown, polished, wing base mostly brownish, subcosta and stigma brownish, membrane uniformly tinged with brown, legs brownish, the tarsi and hind tibiae not so dark brown, legs mostly covered with whitish hairs, excepting the ends of the femora, all of the tibiae and tarsi which have dark brownish hairs, hind metatarsi at most hardly wider than mid metatarsi and nearly half as wide as hind tibiae at apex of the latter; propodeum with its enclosure poorly defined, with irregular rugae on basal half, finely reticulated on apical half, rounded off at apex, rest of upper face sculptured somewhat like the mesopleura and covered with dark brown to blackish hair, propodeal pleura sculptured apparently like the mesopleura the sculpture not hidden by the uniformly distributed dark brown hairs; abdomen with its tergum shining, almost polished, finely reticulated and indistinctly punctured, the punctures mostly three or more puncture widths apart, first tergite, with erect pale ochreous hairs, second and following tergites with dark, brownish hairs, second tergite with its elevated portion poorly defined, not clearly discernible, margins of the tergites not so dark as the remainder of the tergite, hair at apex of abdomen of a golden hue. In the hypopygium this has points in common with *A. haroldi* Viereck MS., but the seventh sternite ends in a strip-like stylus, the eighth sternite is parallel-sided, rounded at apex, hypopygium with slender process and end of lingam slender.

CONTRIBUTION TO THE CLASSIFICATION OF THE BREMIDAE (BUMBLE-BEES) OF CENTRAL AND SOUTH AMERICA

BY THEODORE H. FRISON

Natural History Survey, Urbana, Illinois

The present paper is the result of a study of a series of bumble-bees contained in the collections of the United States National Museum, Carnegie Museum, American Museum of Natural History, American Entomological Society, Hawaiian Sugar Planters' Association, Museum of Comparative Zoology, Cambridge, Massachusetts, the Museum of Zoology, Ann Arbor, Michigan, and of the author. For the loan of material, information, and courtesies of a varied nature I am under special obligation to Mr. S. A. Rohwer, Mr. F. M. Gaige, Mr. H. Kahl, Dr. F. E. Lutz, Mr. P. N. Timberlake, Dr. Nathan Banks, and E. T. Cresson, Jr.

The subject matter of this paper has to deal with the recognition of two new species, six new varieties, the redescription of the male of *B. opifex* (F. Smith), and notes concerning the synonymy, distribution, characters, etc. of certain previously known forms of Central and South America. As everyone knows who has studied the classification of the bumble-bees, the pubescence of many species of these large bees is subject to a marked variation in color. In taking cognizance of varieties the writer has always tried to follow a conservative course and varietal or trinomial names are assigned or used only where the color variation is of such a marked character that the assignment of a name is a direct aid to the classification of the group, or will facilitate the recording of data which have an ecological significance. In other words, trinomials are only used for the forms of a species representing the end series of tendencies in color variations and the most important intermediate phases.

A. Descriptions

Psithyrus mysticus new species

Male.—Face, occiput and checks with black pubescence. Malar space as long as its width at articulation with mandible. Ocelli situated above the narrowest part of the vertex; lateral ocelli transversely bisected by an imaginary supra-orbital line, as far distant from each other as from the inner margin of the compound eye. Flagellum slightly over three times as long as the scape; third antennal segment longer than the fourth, fifth segment much longer than the third.

Thorax on venter, pleura, and dorsum, except for a small nearly impunctate area on the disk of the mesonotum, covered with black pubescence.

Abdomen with dorsum, pleura and venter entirely covered with black pubescence. Genitalia as shown in figure 4. Volsella and squama almost identical with those of *Psithyrus laboriosus* (Fabricius). Heads and shafts of sagittae similar to those of *P. laboriosus*, but more robust. Distal ends of the stipes more rounded than in *P. laboriosus*. Inner and outer spathae as in figures 18 and 19, respectively.

Legs with black pubescence, except for short ferruginous setae on inner surfaces of metabasitarsi and on all surfaces of the remaining tarsal segments. Outer aspect of the hind tibia convex, with hairs bordering anterior and posterior margins longer and more numerous than those on middle portion. Metabasitarsus with moderately long pubescence on posterior margin, distinctly concave, slightly over three times as long as width at widest part, distal posterior angle rounded.

Wings strongly suffused with brown.

Length, 15 mm.; spread of wings, 33 mm.; width of abdomen at second segment, 6 mm.

Holotype.—Male. Negrito, Honduras, March 22, 1923. Collector, T. H. Hubbell. Holotype deposited in the Museum of Zoology, University of Michigan, Ann Arbor, Michigan.

This is the first instance of a species of *Psithyrus* being recorded from Honduras. Three additional species of this genus, *intrudens* (F. Smith), *guatemalensis* Cockerell, and *sololensis* Franklin, have been recorded, however, from Mexico and Central America. A fourth species, *brasiliensis* (F. Smith), was described from a specimen purporting to come from Pará, Brazil, but since no other specimens of *Psithyrus* have ever been found south of the Isthmus of Panama, there is some doubt as to the authenticity of this locality record.

The structural characters of *P. mysticus* show clearly that this species belongs to the *Laboriosus* Group of Franklin (1913). It is easily separated from the other species of *Psithyrus* from Mexico and Central America by its coloration. In fact, it is the only species of *Psithyrus* described from the New World which is, except for the distal portion of the legs, entirely covered with a black pubescence. This feature of its coloration is of particular interest since there are several species of bumble-bees from Central and South America which are similarly colored. Thus, a striking example of color homomorphism between a species of *Psithyrus* and several species of *Bremus* is presented.

Bremus ephippiatus var. **variegatus** new variety

Male.—Structurally similar to the male of *Bremus ephippiatus* (Say) as described by Franklin (1913). Differs from the previously described males of this species in having the sides of the second and the entire third dorsal abdominal segments covered with dark ferruginous pubescence.

Holotype of variety.—Male. Boquete, Chiriqui Province, Panama, March 29, 1923. Collector, F. M. Gaige. Holotype deposited in the Museum of Zoology, University of Michigan, Ann Arbor, Michigan.

The coloration of the typical male of *ephippiatus* is nearly identical with that of the workers. The variety of the male here described as *variegatus* presents color characters somewhat transitional between those of the typical workers and queens. It is further evidence in support of the correctness of the association of the differently colored males, workers and queens of this species. Crawford (1906) has recorded workers of *ephippiatus* having the "pubescence of the second and third dorsal abdominal segments sometimes reddish." Franklin (1913) has doubted whether the workers thus described by Crawford were really *ephippiatus*, but the finding of this male with more or less similar color characters indicates the correctness of Crawford's specific assignment. Workers having such reddish pubescence on the second and third dorsal abdominal segments should be regarded as variety *variegatus*.

Bremus robustus var. **curiosus** new variety

Male.—Face with a mixture of whitish and chocolate-brown colored hairs above and below the articulation of antennae;

hairs on clypeus almost entirely grayish; occiput and occipital orbits with chocolate-brown colored hairs; mandibles with long golden hairs fringing ventral margin, surface densely covered with shorter suppressed hairs of the same color interspersed with some erect chocolate-brown hairs on proximal portion. Malar space about twice as wide at articulation of mandible as long, smooth, shining. Labrum sparsely punctate, with two slightly convex, almost impunctate tuberculate areas on each side of its meson. Eyes somewhat swollen in appearance, so that they bulge out from the sides of the head and the vertex appears depressed between them. Ocelli large, located about one-third the distance from the supra-orbital line towards the point of articulation of the antennae; anterior ocellus extending cephalad of lateral ocelli by about one-third its length. Space directly cephalad of ocelli as well as space between compound eyes and ocelli, smooth, shining, almost impunctate; space directly caudad of ocelli well punctate. Scape of antennae about as long as the following four segments; first segment of flagellum noticeably longer than the second, third and fourth segments about subequal in length.

Thorax, except upon pronotum, scutellum, and bare impunctate area of mesonotum, covered with black or chocolate-brown colored pubescence; dark pubescence of pronotum strongly mixed with dirty whitish or grayish colored hairs, similarly colored hairs are interspersed with the dominant dark hairs on the scutellum.

Abdomen with venter, pleura and first five dorsal segments covered with dark pubescence, sixth and seventh dorsal segments mostly dark but also with some dirty whitish or grayish hairs. Genitalia identical with that of *B. robustus* (F. Smith).

Legs, except distal segments of tarsi, covered with black or chocolate-brown colored hairs of varying length, those on posterior margins of femora, tibiae and basitarsi longest. Outer aspect of the hind tibia strongly convex, with a few short setae on polished mesal area; metabasitarsus slightly concave, about one-sixth as wide at base as long.

Wings a light transparent brown, the nervures more heavily infuscated.

Length, 15 mm.; spread of wings, 36 mm.; width of abdomen at second segment, 8 mm.

Holotype.—Male. Baños, Oriente, Ecuador. December 29, 1922. Collector, F. X. Williams. Five paratypic males, Baños, Oriente, Ecuador, 6,000 feet altitude. October 26, 1922. Collector, F. X. Williams. Holotype male deposited in the collection of the author. Paratypic males deposited in the collections of

the Hawaiian Sugar Planters' Association, United States National Museum and that of the author.

Worker (Female).—Structurally similar to the typical workers of *robustus* (F. Smith) as described by Franklin (1913). Differs in coloration from previously described workers or queens of *robustus* in having the pubescence of the body entirely black, except for a few light colored hairs on the fifth and sixth dorsal abdominal segments.

Allotype.—Worker. Baños, Oriente, Ecuador. December 29, 1922. Collector, F. X. Williams. One paratypic worker, Baños, Oriente, Ecuador, 6,000 feet altitude. October 26, 1922. Collector, F. X. Williams. Allotypic worker deposited in the collection of the author. Paratypic worker deposited in the collection of the Hawaiian Sugar Planters' Association.

This form is named because it represents the end of the series in the variation of *robustus* towards a black (melanic) form. The genitalia of this male affords conclusive evidence of its relationship with *B. robustus* (F. Smith). Attention should be called, however, to the close relationship also existing between *robustus* and *volucelloides* (Gribodo). Since the male of this latter species has not been recognized there is some possibility that the variety here described may be the male of *volucelloides*—a species it closely resembles in coloration except for the smaller amount of white pubescence upon the apical abdominal segments. Franklin has noted the close relationship existing between these two bumble-bees and has suggested that *volucelloides* "may, indeed, be only a subspecies of it [*B. robustus*]." It should be borne in mind in this connection that two species of bumble-bees easily separated in the female caste sometimes have males whose genitalia are almost identical.

Bremus robustus var. **gaigei** new variety

Worker (Female).—Structurally similar to the typical workers of *robustus* (F. Smith) as described by Franklin (1913). Differs in coloration from the previously described workers and queens of *robustus* as follows: the pubescence of the first dorsal abdominal segment is almost entirely black, and the yellow pubescence of the second and third dorsal abdominal segments is confined to the middle area.

Holotype.—Worker. Mt. San Lorenzo, Santa Marta Mountains, Colombia. Collected June 10, 1920, at 5,000 feet altitude,

by Mr. F. M. Gaige. Six paratypic workers from the same place and date as the holotype. The holotype is deposited in the collection of the Museum of Zoology, Ann Arbor, Michigan, and paratypes in the same collection, the United States National Museum and in the collection of the author.

Male.—Structurally similar to the male of *robustus* var. *curiosus* as described in this article. Differs in coloration from the typical male of *robustus* (F. Smith), as described by Franklin, as follows: the pubescence of the first dorsal abdominal segment is almost entirely black, and the yellow pubescence of the second and third dorsal abdominal segments is confined to the middle area.

Allotype.—Male. Baños, Oriente, Ecuador. Collected December 29, 1922, by Mr. F. X. Williams. Three paratypic males; one collected at the same place and on the same date as the allotype, one October 26, 1922, at Baños, Oriente, Ecuador (F. X. Williams), and another at Las Nubes, Department of Magdalena, Colombia, at an altitude of 4,500 feet, in December, by Mr. H. H. Smith. Allotypic male deposited in the collection of the author, paratypic males deposited in the collections of the Carnegie Museum, the Hawaiian Sugar Planters' Association and in that of the author.

Bremus robustus (F. Smith) is exceedingly variable in coloration as is indicated by the two varieties described in this paper and those named by Friese in 1904. Variety *gaigei* is intermediate in coloration between the typical *robustus* as described by Franklin in 1913, and *robustus* variety *hortulans* Friese (1904). In describing the typical male of this species, in 1913, Franklin was unable to give the comparative antennal lengths of the male because the antennae of all the specimens before him were missing. The comparative antennal lengths given with the description of *robustus* variety *curiosus* in this article will apply equally well for the typical males and all other male varieties of this species.

Bremus atratus var. **annulatus** new variety

Male.—Similar in external morphology and structure of genitalia to *Bremus atratus* (Franklin). Differs from *atratus* in that the pubescence of the third dorsal abdominal segment is yellow instead of black. Pubescence on remainder of the body black as in *atratus.*

Holotype.—Male. Chapada, Brazil. April. Collector, H. H. Smith. Holotype of variety deposited in the collection of the Carnegie Museum, Pittsburgh, Pennsylvania.

The structure of the genitalia of this black form clearly shows its close affinity with *B. atratus*, and for this reason it is described as a color variety rather than a distinct species. That South and Central American bumble-bees normally entirely black may occasionally have some yellow pubescence is conclusively proven by the condition presented by a queen of *B. kohli* (Cockerell) in the collection of the author. *B. kohli* is the one species of Central and South American *Bremus*, normally entirely black, which does not present any difficulty in specific determination in the female sex. This is because of its unusually long malar space; a condition found in both the males and females. All of the specimens of this species heretofore reported have had the pubescence of the body entirely black. One specimen of the queen of this species in my collection, however, has the left side of the third dorsal abdominal segment yellow, the remainder of the segment and body having black pubescence as normal for the species.

Bremus atratus var. **alternans** new variety

Male.—Similar in external morphology and structure of genitalia to *Bremus atratus* (Franklin). Differs from *atratus* in having the pronotum, scutellum and third dorsal abdominal segment covered with yellow pubescence, and with a slight mixture of light colored hairs on the occiput and face. Pubescence otherwise black as in *atratus*.

Holotype.—Male. Desterro, Brazil. December. Paratypic male, Paraguay. Holotype of variety deposited in the collection of the author and paratype in the collection of the United States National Museum.

As in the case of variety *annulatus*, this form is considered as a color variety of *Bremus atratus* because of its structural characters. It evidently illustrates a stage farther in the development of the yellow color markings. It differs from the variety *annulatus* described in this article in having the pronotum and scutellum yellow instead of black.

Bremus niger var. **signatus** new variety

Queen (Female).—Structurally similar to *Bremus niger*

(Franklin). Differs in having a band of yellow pubescence on the third dorsal abdominal segment.

Holotype.—Queen. Alto Itatiaya, Serra do Itatiaya, Southeastern Brazil. Collected February 21, 1922, at an altitude of 7,150 feet, by E. G. Holt. Holotype of variety deposited in the collection of the author.

The presence of a transverse yellow band on the dorsum of the abdomen causes this variety to superficially resemble *Bremus mexicanus* (Cresson) and certain recorded color varieties of *Bremus medius* (Cresson). The metabasitarsus, however, is quite suddenly arcuate at its base in variety *signatus*, a character which prohibits the specimen just described being regarded as *mexicanus*. The lighter color of the wings of *B. medius* will diferentiate this species from variety *signatus*. Proof that species normally entirely black occasionally produce specimens with yellow markings has been given in the discussion following the description of *atratus* variety *annulatus*.

Bremus rohweri new species

Male.—Face both below and above the articulation of the antennae and occiput with a mixture of black and yellow hairs. Occipital orbits with yellow hairs dominating. Malar space about as long as its width at articulation with mandible, about one-third as long as greatest width of and one-sixth length of the eye. Ocelli situated in the narrowest part of the vertex below the supra-orbital line; lateral ocelli slightly closer to the inner margin of the eyes than to one another. Flagellum three times as long as the scape; third and fifth antennal segments almost subequal in length, the fourth much shorter than either.

Dorsum of thorax covered with dull yellow pubescence, except for an indistinct band of blackish hairs between the wings. Pleura covered with dull yellow pubescence extending to the basis of the legs.

Abdomen with the first two dorsal segments entirely covered with dull yellow pubescence; remaining dorsal segments with dull ferruginous or burnt sienna colored pubescence, except that pubescence on apical segment is more whitish. Ventral segments with dull yellowish pubescence, that on apical segments becoming more ferruginous. Genitalia and inner and outer spathae as shown, respectively, in figures 6, 16 and 17.

Trochanters and femora with a considerable amount of long dull yellowish hairs. Hairs on tibiae more ferruginous or burnt sienna colored; metatibiae somewhat convex, with but few

short hairs on mesal area and fringed on margins, particularly the posterior margin, with long ferruginous hairs. Tarsi, except basal posterior margin of metabasitarsus which has long hairs, with short stout ferruginous hairs. Metabasitarsus three and two-thirds times as long as greatest width, apical outer half distinctly concave.

Wings moderately stained with brown.

Length, 17 mm.; spread of wings, 33 mm.; width of abdomen at second segment, 7 mm.

Holotype.—Male. Mountains near Valera, Venezuela, 8,000-11,000 ft. altitude. Collected by E. P. de Bellard. Deposited in the collection of the United States National Museum.

Worker.—Face, occipital orbits and occiput with black hairs. Labrum with tubercle-like areas narrow and moderately separated; upper or posterior portion of tubercle-like areas punctate, lower or anterior portion smooth and shining; shelf-like projection not prominent, nearly one-half as broad as the labrum. Mandible three-toothed, with numerous minute and a few large well scattered punctures; setae on distal portion dense, short and of a golden-brown color, a few long hairs on lower proximal portion. Clypeus, particularly so on declivous lateral and posterior surfaces, with numerous punctures; anterior mesal portion almost impunctate, smooth and shining. Malar space as long as its width at articulation with the mandible; slightly over one-half as long as greatest width of and about one-fifth length of eye, impunctate, polished. Ocelli situated slightly above the narrowest part of the vertex, just below the supra-orbital line; lateral ocelli slightly closer to the inner margin of the eyes than to one another; area directly laterad of each lateral ocellus with punctures extending half-way from inner margin of eye to ocellus, the mesal portion being impunctate and polished. Eyes slightly swollen, but not noticeably bulging out from the sides of the head. Flagellum slightly over twice as long as the scape; third antennal segment considerably longer than the fifth, the fifth longer than the fourth.

Dorsum of the thorax covered with yellow pubescence, except for a distinct black band of pubescence between the wings, the band being about one-half as broad as its length between wings. Mesopleura with dull yellow pubescence extending to the basis of the legs, hairs on metapleura and propodeum somewhat darker.

Abdomen with the pubescence on dorsal segments colored as follows: two basal segments yellow, third segment black, and remaining three apical segments ferruginous. Ventral segments primarily with dark colored pubescence, but tinged particularly

on apical segments with ferruginous. Hypopygium without a median carina.

Legs black, but with the usual short stout ferruginous hairs or setae on tarsi, particularly posterior surface of metabasitarsus. Corbicular fringes black. Metabasitarsus distinctly arcuate on posterior margin, concave on outer or anterior surface, the most concave portion being nearly destitute of the short black setae which are particularly abundant on the anterior margin, posterior fringe short.

Wings moderately stained with brown.

Length, 12 mm.; spread of wings, 24 mm.; width of abdomen at second segment, 6.5 mm.

Morphotype.—Worker (female). Mountains near Valera, Venezuela, 8,000–11,000 ft. altitude. Collected by E. P. de Bellard. Deposited in the collection of the United States National Museum.

I take pleasure in naming this new species for Mr. S. A. Rohwer, to whom I am indebted for many courtesies.

I am considering the male and worker here described as the same species on the basis of their structural characters, coloration and habitat. The bumble-bee fauna of Central and South America is limited and the discovery of a new species in the mountains of Venezuela is no indication that numerous new species of these bees await description from this region. This is an additional reason for considering the male and worker named *rohweri* as the same species, the only other alternative being to describe each separately as new because neither can be satisfactorily placed with any other known species.

B. rohweri is most closely related to *B. funebris* (F. Smith). This is evident by the structure of the male genitalia. The two species may be easily separated, however, by their marked difference in coloration and the malar space of *B. funebris* is slightly shorter than that of *rohweri*. Thus far, no specimens of *funebris* have been discovered which would indicate that this species exhibits a range of color variations such as displayed by *B. robustus* (F. Smith). It is an interesting feature of the coloration of the bumble-bees, that some species are highly variable, whereas other closely related forms are very constant. The male of *B. opifex* (F. Smith) superficially looks much like *rohweri*, but it may be easily distinguished from it by several

good structural characters, the best of which are offered by the genitalia.

Bremus opifex (F. Smith)

This species was originally described from the worker caste by F. Smith in 1879. Since then the queen has been described by Vachal (1904) and redescribed in greater detail by Franklin (1913). Vachal also described the male in 1904, but his description is so limited that the following redescription based upon a specimen in my collection is given. Furthermore, the genitalia of the male has not been previously figured or studied.

Male.—Face below and above the articulation of the antennae and occipital orbits with a mixture of black and gray colored hairs. Occiput with a triangular patch of dominantly black hairs, a few grayish hairs being intermixed. Malar space slightly longer than its width at articulation with mandible, about two-thirds as long as greatest width of and about one-third length of the eye. Ocelli situated between eyes above the narrowest part of the vertex; lateral ocelli about as far distant from each other as from the inner margin of the eye. Flagellum slightly over four times as long as the scape, middle segments somewhat arcuate when viewed from the side; fifth segment almost twice as long as the third, the fourth considerably shorter than the fifth but slightly longer than the third.

Dorsum of the thorax with the pronotum and scutellum covered with yellow pubescence, a distinct band of black pubescence between the wings. Pleura with yellow pubescence extending to the basis of the legs.

Abdomen with the first four dorsal segments entirely covered with yellow pubescence, the last three with dull ferruginous or burnt sienna colored pubescence. Apical margins of basal ventral segments fringed with yellowish hairs, those on apical segments becoming more ferruginous; basal area of each ventral segment with brownish to black hairs, particularly noticeable on the second segment. Genitalia and inner and outer spathae as shown, respectively, in figures 7, 14 and 15.

Legs with short black or brownish hairs, except on the lower surface of femora where the hairs are longer and have a whitish-yellow color. Outer aspect of hind tibia convex, covered with short stout hairs, no trace of a corbicula such as found in males of *Terrestribombus* Vogt; metabasitarsus three and one-half times as long as wide, concave.

Wings weakly stained with brown.

Length, 18 mm.; spread of wings, 33 mm.; width of abdomen at second segment, 7 mm.

The male comes from Potrerillos, Mendoza, Argentina, collected March 18, 1921, by Alexander Wetmore.

The characters presented by the male genitalia of this species are not duplicated by any other species of South American Bremidae known to me and it offers an excellent character for the positive identification of this species.

B. Notes on Synonymy

A study of several types of Central and South American Bremidae in the collection of the British Museum by Meade-Waldo (1916) has necessitated the use of certain specific names different from those given by Franklin in his excellent paper of 1913. Attention is called to these changes in this article, and certain other matters regarding synonymy, so that they may be more generally noted and recognized by American workers.

The result of a study of types of several other species contained in the United States National Museum is also included here. Furthermore, under this heading it seems advisable to report upon results of a study of a series of Central and South American bumble-bees kindly loaned me by Dr. Frank E. Lutz of the American Museum of Natural History. These specimens were obtained by the American Museum of Natural History from Dr. H. Friese, and their study has enabled the writer to settle several points of a doubtful nature regarding the systematic status of certain species and varieties, as well as to check up on the identity of those species listed under similar names by both American and European systematists.

Bremus mexicanus (Cresson)

Bombus unifasciatus Smith, Descr. New Spec. Hym., 1879, p. 133, n. 8.

The type of *B. unifasciatus* described in 1879 by F. Smith was located in the British Museum by Meade-Waldo (1916). According to this author, *unifasciatus* is identical with the species described by Cresson in 1878 as *mexicanus*. It was doubtfully placed in the synonymy of *mexicanus* by Franklin in 1913.

Bremus formosus (F. Smith)

Bombus pulcher Cresson, Proc. Ent. Soc. Phila., II, 1863, p. 108, n. 42.

It has also been shown by Meade-Waldo (1916) that *B. pulcher* (Cresson), described in 1863, is synonymous with

B. formosus (F. Smith), dating from 1854. This definitely settles the old argument about whether "there is an East Indian species closely resembling the American one in coloration." F. Smith was in error in stating that his specimen came from Formosa. The present known distribution of *B. formosus* also precludes the assumption that Smith's specimen came from the Province of Formosa in northern Argentina. This change in synonymy, unfortunate because of the misleading specific name, has already been recognized in an American list by Lutz and Cockerell (1920). The specific name *pulcher* was used by Franklin in 1913.

Bremus bellicosus (F. Smith)

Bombus thoracicus Sichel, Ann. Soc. Ent. France, (4), II, 1862, p. 121. (Not of Spinola, 1806.)

Bombus emiliae Dalla Torre, Wien. Ent. Zeitg., IX, 1890, p. 139, nom. nov.

I am adopting the specific name *bellicosus* (F. Smith),of 1879, for the species listed as *Bombus emiliae* Dalla Torre by Franklin (1913). This species of bumble-bee was first described by Sichel (1862) under the name of *thoracicus*. This specific name, however, was previously assigned by Spinola, in 1806, to a species of bumble-bee occurring in Italy. As a result of this duplication of names within the genus and unaware of the true status of *bellicosus*, Dalla Torre proposed the name *emiliae* for this species. Meade-Waldo, (1916), after studying the type, states that *bellicosus* is synonymous with *emiliae* (=*thoracicus*). Furthermore, he says that the type does not bear a locality label and that "Sumatra or India" was only a guess as to locality on the part of F. Smith.

Bremus huntii var. **laticinctus** (Franklin)

Bombus laticinctus Franklin, Trans. Amer. Ent. Soc., XXXIX, 1913, p. 85.

A study of cotypes convinces the writer that this form is merely a color variety of *B. huntii* (Greene). It is separable from *huntii* only by the much broader black band of pubescence between the wings. *Huntii* is known to occur in Arizona and New Mexico and it is not surprising that this species is found in Mexico. Collections from Central America proper and South America fail to produce this species and Mexico probably represents its southernmost limit of distribution.

Bremus rufocinctus var. **mexicensis** (Franklin)

Bombus mexicensis Franklin, Trans. Amer. Ent. Soc., xxxix, 1913, p. 138.

In this instance also, a study of cotypes convinces the writer that this form is merely a color variety of the most variable of North American bumble-bees, *B. rufocinctus* (Cresson). Like *B. huntii* var. *laticinctus* it is separable from the typical form by the much broader black band of pubescence between the wings. The occiput is also slightly darker. Since *B. rufocinctus* occurs in Arizona and New Mexico the presence of this species in Mexico is not surprising, though this latter country probably represents the extreme southernmost distribution of the species.

Bremus diligens (F. Smith)

Bombus brachycephalus Handlirsch, Ann. Naturh. Hofmus. Wien., iii, 1888, p. 244.

Meade-Waldo says that *diligens* (1861) is the same species as *brachycephalus* (1888) and I am accepting this synonymy.

Bremus nigrodorsalis (Franklin)

Bombus laboriosus Smith, Journ. of Ent., i, 1861, p. 153, n. 3.

Bombus ephippiatus var. *montezumae* Cockerell, Ann. Magaz. Nat. Hist., ser. 8, i, 1908, p. 344.

The type of *B. laboriosus*, described by F. Smith in 1861, was located by Meade-Waldo. A comparison of this type with specimens of *B. nigrodorsalis* proved that the two were the same species. The name *laboriosus*, however, is not available for this species because *Psithyrus laboriosus* (Fabricius) was originally described in 1804 as a *Bombus*. The name *nigrodorsalis* of Franklin (1907) is therefore the first available name. Franklin, in 1913, called attention to the fact that *montezumae* (Cockerell) described in 1908, was a variety of *nigrodorsalis*.

Bremus sulfuratus (Friese)

Bombus robustus var. *sulfuratus* Friese, Deutsch. Entom. Zeitschr., 1911, p. 457.

There is one worker in the collection of the American Museum of Natural History named by Friese as *robustus* var. *sulfuratus*. According to the data with the specimen it must be one of the cotype workers, although it is not so labeled. A careful study of this specimen convinces me that *sulfuratus* is not a variety of *robustus* and should be considered as a distinct species; a conclusion previously reached by Franklin (1913).

Judging by this worker, *sulfuratus* may be easily separated from *robustus* (F. Smith) by its slightly longer malar space, the more punctate clypeus (a mixture of large and small punctures, particularly on the lateral and anterior margins), the less prominent and more transverse tubercles of the labrum, and the frontal transverse ridge of the labium is of greater extent. Furthermore, the lateral half of the area between the compound eye and lateral ocellus is closely and finely punctate in *sulfuratus*, whereas in *robustus* the punctures are much less numerous. Especially important is the fact that the ocelli are situated about on a line with the supra-orbital line and above the narrowest part of the vertex and that the mesobasitarsus is sharply pointed at its distal posterior angle. These last two morphological characters are quite at variance with the condition encountered in the case of *robustus* and afford conclusive evidence that *robustus* and *sulfuratus* are not even closely related. In fact the latter belongs to a different classificatory section of bumblebees and is not a *Bombias* form as is *robustus*.

Franklin, while considering *sulfuratus* as distinct from *robustus*, nevertheless, thought it was "apparently closely related to *robustus*" and considered *sulfuratus* as a *Bombias*. Since Franklin studied a queen and worker which were also probably from the type series, it seems either that Friese has mixed three species under the name *sulfuratus* or that Franklin was mistaken in regarding it as a *Bombias*, whereas it is a true *Eremus* (*Eombus*).

It may also be recorded that the specimen of *sulfuratus* I studied exhibited a tendency for the dark pubescence on the dorsum of the mesonotum to extend caudad onto the scutellum. This is contrary to the general scheme of color variation in the light colored varieties of *robustus* that I have studied.

Bremus weisi (Friese)

A study of a male of this species determined by Friese, shows that the original description and the redescription of the species by Franklin (1913) are both adequate to correctly place this *Bombias* form. The male was collected at San Antonio, Colombia, in 1908. Since the genitalia and inner and outer spathae of this species have not been previously figured they are shown in figures 3, 8, and 9, respectively.

Bremus volucelloides (Gribodo)

Two specimens of this species, a worker and a queen, both determined as this species by Friese were studied. They agree very well with Franklin's (1913) redescription of this species, and my interpretation of the species of bumble-bee described by Gribodo in 1891 as *volucelloides*. The queen was collected in February, 1921, at San Mateo, Costa Rica, and the worker in December, 1920, at San José, Costa Rica.

Bremus rubicundus (F. Smith)

One queen of this species determined by Friese was studied. The specimen agrees very well with Franklin's excellent redescription of the species (1913), and with my interpretation of F. Smith's (1854) original description. The specimen came from St. Parime, Venezuela, 1897.

Bremus ephippiatus var. **schneideri** (Friese)

Bombus schneideri Friese, Zeitsch. f. Systemat. Hym. u. Dipt., III, 1903, p. 253.

Bombus schneideri var. *fuliginosus* Friese, Zeitsch. f. Systemat. Hym. u. Dipt., III, 1903, p. 253.

Bombus schneideri var. *badiocollis* Friese, Stettiner Ent. Zeitung, 77, 1916, p. 348, n. 150.

A study of a queen from San Mateo, Costa Rico, determined by Friese as *B. schneideri* Friese, convinces the writer that this is the queen of *B. ephippiatus* (Say); a conclusion previously reached by Franklin (1913). Say's original description of the species was made from either a worker or a male. It so happens, however, that the queen is differently colored and affords a type of dimorphism somewhat unusual among the Bremidae. The queens agreeing with Friese's description of *schneideri* are the normal form of the queen (with much ferruginous pubescence on the dorsum of the thorax and abdomen). Queens and workers of this species taken in the same nest (Crawford, 1906) offer conclusive proof that these differently colored forms are the same species. It does not seem altogether improbable though, that future collecting may reveal similarly colored workers and queens. This is suggested by the coloration of the male (*ephippiatus* var. *variegatus*) described as new in this article, and certain remarks of Crawford (1906) about the workers with "Pubescence of second and third abdominal segments sometimes

reddish." Because of these transitional forms it seems advisable at least for the present to retain *schneideri* (Friese) as a varietal name. The varieties *fuliginosus* and *badiocollis* are based upon such slight color differences, however, that their retention does not seem advisable.

Bremus rubicundus var. **bicolor** (Friese)

Bombus bicolor Friese, Zeitschr. f. Systemat. Hym. u. Dipt., III, 1903, p. 254.

A study of the genitalia of a male collected at Quito, Ecuador, and determined by Friese as *bicolor*, proves that Franklin (1913) was correct in considering *bicolor* (1903) conspecific with *rubicundus* (F. Smith) of 1854. Smith's description was based upon a queen which had the pubescence of the dorsum of the abdomen almost entirely dark ferruginous. *B. bicolor* was described from a worker having the pubescence of the second and third dorsal abdominal segments black. The latter type of color variation is also found in the case of the males as this specimen shows, and eventually queens may be found with a similar color pattern. The name *bicolor* may be advisedly used for those specimens of *rubicundus* of any caste or sex which have a large amount of black pubescence on the second and third dorsal abdominal segments.

Bremus baeri (Vachal)

One specimen from Peru determined as this species by Friese was studied. Franklin (1913) doubtfully placed *bicoloratus* (F. Smith), described in 1879, in the synonymy of this species and raised the question as to whether *bicoloratus* came from the "Island of Formosa" or South America. As mentioned under the discussion of *Bremus formosus*, Smith did make a mistake in listing the localities of two species of South American bumblebees. In this instance, however, Smith seems to have been correct in his locality assignment for *bicoloratus*, because Cockerell (1911) has recorded a bumble-bee from Formosa as agreeing with Smith's description. Therefore, the name *bicoloratus* can be stricken from the American lists.

Bremus butteli (Friese)

One worker from Huancabamba, Peru, determined by Friese. This is the only specimen of this form that I have seen. It

differs somewhat from Franklin's (1913) redescription of the species in having the pleura almost entirely covered with a light golden colored pubescence. If the dorsum of the thorax was similarly colored this specimen would strongly resemble in color pattern *B. rubicundus* var. *bicolor* Friese. The transitional structural *Bombias* characters of both *rubicundus* and *butteli* suggest the possibility of the latter being merely a color variety of the former, but the evidence is not sufficiently conclusive at present to justify a final conclusion. Further evidence in support of this position, however, lies in the geographical distribution of the two forms involved, and the fact that no males or queens of *butteli* have been recorded. If *butteli* is a color variety of *rubicundus*, the cinereous pubescence of the thorax of the former would exhibit a case parallel to the condition found in the workers, queens and males of *B. ephippiatus* (See discussion of dimorphism under *B. ephippiatus*).

Bremus carolinus (Linnaeus)

One specimen of a worker from Popayan, Colombia, collected December 4, 1908, and determined by Friese as this species, was studied. Friese's determination of this specimen as *carolinus* establishes the agreement that exists between European and American workers as to the form described by Linnaeus (1767) under this name. Cockerell (1921) has recently published a note on a specimen labeled *rubriventris* in the Hope Collection at Oxford, England. This material passed through the hands of Lepeletier and it is possible that the specimen Cockerell studied is, as he states, the type of *rubriventris*. Cockerell says that the malar space is moderate in length, "rather shorter than in *brasiliensis*", and if it were not for this statement I would be inclined to consider *rubriventris* as a synonym of *carolinus*, or at the most a color variety having the fifth dorsal abdominal segment black instead of ferruginous. *Carolinus* (Linnaeus), as redescribed by Franklin, has a very long malar space—much longer than has *brasiliensis* (Lepeletier).

Bremus coccineus (Friese)

One worker from Peru determined as this species by Friese was studied. The form seems sufficiently distinct to entitle it to specific rank.

Bremus kohli (Cockerell)

One worker and one male from Espirito-Santo, Brazil, and a queen from São Leopoldo, Brazil. All determined by Friese as *B. violaceus* (Lepeletier). This is the species named *carbonarius* by Handlirsch (1888), and later, because this name was preoccupied, assigned the name *kohli* by Cockerell (1906). It is impossible to tell from the descriptions of *velutinus* (Illiger), 1806, and *violaceus* (Lepeletier), 1836, just exactly in either case what species of bumble-bee is described. All one can definitely ascertain from these descriptions is that each name applies to an entirely black species of bumble-bee. When we consider that there are at least four distinct South and Central American species of black bumble-bees and black varieties of several other species, the use of these names rests upon a very arbitrary basis. It seems to the writer, therefore, that it is not advisable to use either of these old names for the present for this species. To facilitate the recognition of this black species the genitalia, inner and outer spathae are shown, respectively, in figures 2, 12, and 13.

Bremus robustus (F. Smith)

A male and a queen from Quito, Ecuador, both named *B. robustus* var. *steinbachi* (Friese) by Friese. These two specimens are certainly the species *robustus* of F. Smith, but since the specimens have the third dorsal abdominal segments almost all yellow and the specimen is otherwise almost typical for the species as described by Smith, I can see no good reason for using the varietal name *steinbachi* in either instance. *Steinbachi* is described as having the third dorsal abdominal segment black, and the name has no significance unless it is used for specimens so colored.

Bremus robustus var. **hortulans** (Friese)

One male from Baños, Ecuador, named by Friese. A well marked variety and usually found in a series of *robustus* from Ecuador.

Bremus robustus var. **curiosus** Frison

One specimen of the queen of this melanic form from Cali, Cauca, Colombia, determined as *B. vogti* (Friese) by Friese, was

studied. Franklin (1913) after a study of a queen and a worker named by Friese considered *vogti* as a variety of *volucelloides* (Gribodo). The present specimen, however, is certainly not a variety of *volucelloides* and is structurally identical with *robustus* (F. Smith), agreeing with the color variety described in this paper as *curiosus*. Morphologically, *volucelloides* can be easily separated from *robustus*, by the comparative lengths of the antennal segments. In *volucelloides* the third antennal segment is but slightly shorter than the fourth and fifth united, whereas in *robustus* the third antennal segment is approximately but two-thirds as long as the following two segments together. It is possible that Friese has mixed two black forms in naming specimens as *vogti*, for the present specimen named by him is certainly more closely related to *robustus* than it is to *volucelloides*. The name *vogti* was originally assigned to specimens with the abdomen "segmentis 1–4 fere nigro-, 5–6 fere albido-hirsutis," which might be the case in either of the two species. Regardless of whether *vogti* is a variety of *robustus* or *volucelloides* the name *curiosus* is needed as a varietal name for the form of *robustus* with the apical dorsal abdominal segments entirely black. If the true *vogti* is a variety of *robustus*, as this Friese named specimen indicates, the name *vogti* is still available and needed as a varietal name for those forms of *robustus* dominantly black except for the whitish or reddish-white apical segments.

Bremus robustus var. **rufocaudatus** (Friese)

A study of the genitalia of a male of this variety from Salta, Argentina, collected in March, 1905, by Steinbach, and determined by Friese, proves that Friese (1903) was correct in considering this form as a color variety of *robustus* (F. Smith). This variety was originally described from specimens taken in Argentina. Franklin (1913), says that "*Rufocaudatus* may be a variety of *robustus*, but, because of its color characters, I suspect it of having affinities with *opifex*." The large eyes of the male, short malar space, position of the ocelli, etc., conclusively show that *rufocaudatus* does not have any close relationship with *opifex*, and that it belongs to a series of species representing another line of development. The description of *rufocaudatus* does not specifically mention the structural characters connecting this variety with *robustus*, but in a discussion beneath

his description Friese remarks that he has placed this variety with *robustus* because of its morphological characters.

C. Distributional Records

The distribution of the Central and South American species of bumble-bees is so poorly known that the publication of the following data is warranted. Many of these records establish new locality records for the species and varieties, while still others are especially worth recording because of the data associated with them.

1. **Bremus robustus** (F. Smith)

Onaca, Dept. Magdalena, Colombia, December, 2500 feet alt., two males, (H. H. Smith); Las Nubes, Dept. Magdalena, Colombia, December, 4500 ft. alt., two males, (H. H. Smith); Valparaiso, Dept. Magdalena, Colombia, 2500 ft. alt., two males, (H. H. Smith); Mt. San Lorenzo, Santa Marta Mts., Colombia, June 10, 1920, 5000 ft. alt., seven queens (F. M. Gaige); Baños, Oriente, Ecuador, 6000 ft., altitude, Oct. 26, 1922, one male, (F. X. Williams).

2. **Bremus robustus** var. **hortulans** (Friese)

Baños, Oriente, Ecuador, 6000 ft. altitude, October 26, 1922, five males and one worker, (F. X. Williams); also three males from the same locality, December 29, 1922, (F. X. Williams). Mt. San Lorenzo, Santa Marta Mts., Colombia, 5000 ft. altitude, June 10, 1920, one worker, (F. M. Gaige); Onaca, Dept. Magdalena, Colombia, 2500 ft. altitude, December, one worker, (H. H. Smith). The specimens from Baños, Ecuador, are from the type locality of variety *hortulans* (Friese) and agree very well with his description of this variety. This variety represents the black tendency of *robustus* and stands intermediate between the typical *robustus* (F. Smith) and the variety described in this paper as *gaigei*. *B. robustus* variety *curiosus*, just described in this paper, represents the end form of this melanic tendency exhibited by *robustus*.

3. **Bremus volucelloides** (Gribodo)

Mt. San Lorenzo, Santa Marta Mts., Colombia, 5000 ft. altitude, June 10, 1920, two queens, (F. M. Gaige); Boquete, Chiriqui Prov., Panama, March 1–29, 1923, one queen and

three workers, (F. M. Gaige); Ujurras de Terraba, Costa Rica, Sept. 10–15, 1907, one worker, (M. A. Carriker, Jr.); Corralillo, Irazú, Costa Rica, Jan.–Feb., 1924, one queen, (F. Tristán).

With the exception of the one worker from Costa Rica and one queen from Boquete, Panama, all the specimens have the second and basal portion of the third dorsal abdominal segment black, thus somewhat approaching in coloration var. *vogti* (Friese, 1903). The typical queen and worker, according to Franklin (1913), have white pubescence on the third and the apical portion of the second dorsal abdominal segments.

4. **Bremus funebris** (F. Smith)

Baños, Oriente, Ecuador, December 29, 1922, two males, (F. X. Williams); Cotocollao, Quito, Ecuador, August, 1924, three males and two workers, (Paul Munos); Pachacayo, Peru, over 12,000 ft. altitude, March 27, two males, (C. H. T. Townsend); Aloag, Ecuador, 2900 m. altitude, five workers.

5. **Bremus rubicundus** (F. Smith)

Honduras, one queen and one male; Valera, Venezuela, one male, (Bellard).

6. **Bremus rubicundus** var. **bicolor** (Friese)

La Teta de Niquitao, Cordillera de Meridá, Venezuela, 10,000 ft. altitude, May 27, 1922, one worker, (M. A. Carriker, Jr.).

7. **Bremus coccineus** (Friese)

Oroya, Peru, May 7–8, 1914, three workers, (C. H. T. Townsend); Pachacayo, Peru, over 12,000 ft. altitude, March 27, one queen and one worker, (C. H. T. Townsend).

8. **Bremus butteli** (Friese)

Piches and Perene Vs., Peru, 2000–3000 ft. altitude, (Soc. Geog. de Lima).

9. **Bremus opifex** (F. Smith)

Incachaca, Bolivia, 2500 m. altitude, March, 1921, one queen, (José Steinbach); Potrerillos, Mendoza, Argentina, 5000 ft. altitude, March 18, 1921, one queen and two males, (Alexander Wetmore).

10. **Bremus formosus** (F. Smith)

Mexico, 1905, three queens, (P. H. Goldsmith); Colima, Mexico, June, one queen and one worker, (Conradt); Coatepec,

Mexico, June, one queen, (Conradt); Dist. Federal, Mexico, July 8, 1910.

11. **Bremus wilmattae** (Cockerell)

Guatemala, three workers.

12. **Bremus ephippiatus** (Say)

Boquete, Chiriqui Prov., Panama, March 1–29, 1923, seven workers and one queen, (F. M. Gaige); Boruca, Costa Rica, July, two males and one worker (M. A. Carriker, Jr.); Irazú, Costa Rica, two queens, (Schild and Burgdorf); Corralillo, Irazú, Costa Rica, Jan.–Feb., 1924, one worker, (F. Tristán); Ujurras de Terraba, Costa Rica, Sept. 1, 1907, one worker; Colima, Mexico, one worker, (Conradt); Orizaba, Mexico, Dec. 23, 1907, one worker, (Knab); Hacienda San Marcos, Jalisco, Mexico, July 11–17, 1905, one worker, (P. H. Goldsmith); El Rancho, Guatemala, one worker, (Kellerman).

This species affords an excellent example of the difference in coloration occasionally exhibited between queens and workers, both of which are females. That the queen and workers are the same species is shown by their morphological characters, distribution, and by the evidence published by Crawford (1906) and accepted by Franklin (1913). According to Crawford, the workers and queens were taken together in the same nest on the Volcano of Irazú, Costa Rica, by Prof. Lawrence Bruner in 1902.

13. **Bremus steindachneri** (Handlirsch)

Mexico, 1905, three queens, four workers and four males, (P. H. Goldsmith); Guadalajara, Jalisco, Mexico, July 3–August 20, 1903, one male and fourteen workers, (McClendon); Distr. Federal, Mexico, one male, (Inda). The genitalia and inner and outer spathae of the male of this species are shown, respectively, in figures 5, 20, and 21.

14. **Bremus dolichocephalus** (Handlirsch)

Orizaba, Mexico, December, 1887, two males, (H. H. Smith and F. D. Goodman).

15. **Bremus kohli** (Cockerell)

Puerto Bertoni, Alto Paraná, Paraguay, 1908, one male; Baros, Ecuador, one queen; Montevideo, Uruguay, one male;

Sapucay, Paraguay, April 7, 1903, one queen, (W. T. Foster); Nangaratiba, Brazil, May 9, 1920, one male, (E. G. Holt); Rio de Janeiro, Brazil, November, one worker and two queens, (H. H. Smith); Uacaryzal, Matto Grosso, Brazil, one worker, (H. H. Smith); Januaria, Minas Geraes, Brazil, December 17, 1907, two workers, (J. D. Haseman); Chapada, Brazil, April, three queens, October, January, February, March, April, twenty-nine workers, November, March, April, five males, (H. H. Smith); Piedra Blanca, Bolivia, April, one male and four workers, (H. H. Smith); Prov. del. Sara, Bolivia, 450 m. altitude, November, 1910, one male, (J. Steinbach).

16. **Bremus mexicanus** (Cresson)

Ecuador, one queen, (C. F. Baker); Boquete, Prov. Chiriqui, Panama, March 9–29, 1923, four workers, (F. M. Gaige); Guatemala, nine workers; Tegucigalpa, Honduras, June 13, 1918 and December, 1912, two workers.

17. **Bremus medius** (Cresson)

Cordoba, Mexico, December 17–23, 1908, one male, two workers and one queen, (F. Knab); Chichen Itza, Meridá, Yucatan, Mexico, one queen, one male, and many workers all from the same nest, (E. Thompson); São Paulo, Brazil, 1918, (Carvalho); Sapucay, Paraguay, (Foster).

18. **Bremus incarum** (Franklin)

Pied Saut, Oyapok River, French Guiana, March, 1918, six workers, (S. M. Klages); Prata, Brazil, June 30, 1919, three workers, (H. S. Parish); Santarem, Brazil, three workers, (H. H. Smith); Benevides, Pará, Brazil, October, 1918, one queen, (S. M. Klages); Hyutanahan, Rio Purus, Brazil, April and February, 1922, three workers, (S. M. Klages); Santa Isabel, Uruguay, November 19, 1909, two workers, (J. D. Haseman); Villa Bella, Bolivia, October 8, 1909, one queen, (J. D. Haseman); Prov. del Sara, Bolivia, November and December, two workers, (J. Steinbach).

19. **Bremus brasiliensis** (Lepeletier)

Puerto Bertoni, Alto Paraná, Paraguay, 1908, one worker.

20. **Bremus sonomae** (Howard)

Dist. Federal, Mexico, one worker, (L. Conradt).

21. **Bremus sonorus** (Say)

Monclova, Mexico, August, 1880, four workers, (Palmer); Sierra Laguna, Lower California, Mexico, 5,400 ft. altitude, August 15, 1919, nine workers, (J. R. Slevin); La Paz, Lower California, Mexico, June 27, 1917, nine workers, (G. F. Ferris). Also, fourteen workers and two queens, April 9–June 19, 1921, collected by E. P. Van Duzee from the following localities in Lower California and the Gulf of California, Mexico: Guaymas, Mulegé, Aqua Verdo, La Paz, San Marcus Island and Tiburon Island. An extensive report on the bees collected by the California Academy of Science Expedition to Lower California, Mexico, has recently been published by Cockerell (1923 24). Unfortunately, no records of bumble-bees are given in this article because these bees were sent to the writer for identification. The specimens here recorded from Lower California and islands in the Gulf of California collected by Mr. E. P. Van Duzee are a part of the material collected by this expedition.

22. **Bremus solus** (Franklin)

Chapada, Brazil, March 5, October 21, four males, (H. H. Smith); Santarem, Brazil, one male.

This is the first time that this species has been recorded since it was described from a unique male in the collection of the United States National Museum, by Franklin (1913). The writer was enabled to definitely place this species through the kindness of Mr. S. A. Rohwer, who sent me sketches of the male genitalia. The structure of the genitalia is quite different from that of any other species of bumble-bee. Since the genitalia of this species has not been previously figured, the claspers, inner and outer spathae are shown in figures 1, 10 and 11. In his key to the Central and South American bumble-bees, Franklin (1913) separates *solus* from *pullatus* and *atratus* by the differences in the comparative lengths of the third, fourth and fifth antennal segments. Some slight differences in comparative antennal lengths exist between these species, but in the specimens before me, the third and fourth segments are more nearly of equal length than "Third antennal segment longer than fourth."

23. **Bremus weisi** (Friese)

Tarbaca, Costa Rica, October, 1902, two males.

24. **Bremus dahlbomii** (Guérin)

Puven, Chile, two queens; Central Chile, seven queens, two workers and two males, (A. Faz); Limache, Chile, February, 1923, two queens, three workers and three males, (A. Faz); Renca, Chile, November 10, two queens, (A. Faz).

25. **Bremus atratus** (Franklin)

Prov. del Sara, Bolivia, November, 1910, 450 m., one male (J. Steinbach); Chapada, Brazil, October, February, March, and May, ten males (H. H. Smith). Franklin states that this species was "described from two males, one from Chiriqui, Panama, and the other from San Bernardino, Paraguay." Through the kindness of Mr. S. A. Rohwer, the writer was permitted to study the specific characters of these cotype males in the collection of the United States National Museum. Since the abdomen of the specimen from Paraguay was missing, the genitalia of the specimen from Chiriqui were exserted for study. This disclosed the fact that the genitalia of this specimen did not agree with Franklin's description or his figures of the genitalia. In fact, the genitalia were typical for *B. pullatus* (Franklin) described from a unique male from Ecuador.

That *B. atratus* was a valid species, however, was evident from Franklin's description and his drawings of the genitalic characters; aside from the confirmatory evidence of the eleven males here recorded with characters such as Franklin described and figured. Evidently the specimen upon which Franklin based his description, and from which the figures of the genitalia were drawn, is the specimen from San Bernardino, Paraguay, with the abdomen missing. Because of this confusion among the cotypes of *atratus*, the specimen from Paraguay belonging to the United States National Museum is selected as the lectotype of the species *atratus* (Franklin). In this connection, it is instructive to note that *B. pullatus* is also represented in the collection of bumble-bees collected in Panama by Mr. F. M. Gaige and here reported upon, whereas *B. atratus* has not to date been found to occur so far northward.

26. **Bremus pullatus** (Franklin)

Boruca, Costa Rica, July, 1907, two males; San José, Costa Rica, 1903, one male; Boquete, Chiriqui Prov., Panama,

March 1, 1923, (F. M. Gaige); Chapada, Brazil, September, December, January, and March, (H. H. Smith).

This species was described from a unique male collected in Ecuador. The capture of additional males of this species in Panama, Costa Rica and Brazil throws considerable light upon the distribution of this species. Attention has also been called in this article to the fact that one of the male specimens from the type series of *B. atratus* collected in Chiriqui, Panama, is really this species. Mr. S. A. Rohwer informs me that the abdomen and genitalia of the unique type of *B. pullatus* in the United States National Museum are missing, but Franklin's description of this species and his figures of the male genitalia are ample for its recognition.

27. **Bremus nigrodorsalis** (Franklin)

Popocatepetl Park, Mexico, 8100 ft. altitude, Sept. 17, 1906, one worker, (P. P. Calvert); Monte Redondo, Costa Rica, Jan., 1903 (C. F. Underwood).

28. **Psithyrus sololensis** Franklin

El Rancho, Guatemala, one male, (Kellerman).

29. **Psithyrus guatemalensis** Cockerell

El Rancho, Guatemala, two males, (Kellerman). No structural differences between this form and *sololensis* have been discovered, and I am inclined to believe that future collecting will prove them to be merely color phases of the same species. The locality records in the present instance are very suggestive of this relationship. Furthermore, several North American species of *Psithyrus* exhibit an almost parallel series of color variations.

30. **Bremus** species

During the course of my studies of Central and South American bumble-bees I have studied over four hundred queens and workers in addition to those of *B. kohli*, with the pubescence entirely black. I have failed to find any constant or tangible characters by which to separate the different species which I am sure are mixed in this lot. That more than one species of female is involved is evident from the fact that eighteen queens and three hundred and fifty-one workers were collected at

Chapada, Brazil, at the same time and place as the black males of *B. pullatus*, *B. solus*, *B. atratus*, and *B. kohli*. The females of *B. kohli* are not included among these unidentifiable specimens, because they are easily recognized by virtue of their extremely long malar space; a character found in both the males and females.

Franklin (1913) has described a single black colored female from Brazil under the name *brevivillus* and eight queens and workers from Brazil, Peru, and Costa Rica by the name *niger*. Franklin says that "I can distinguish *brevivillus* from *niger* only by its shorter and coarser pile." I have been unable to separate with any degree of certainty the black forms, exclusive of *kohli*, by this character, and have considered it inadvisable to list these forms under any specific names for the present. The solution of this problem lies in the correct correlation of the distinctive males with their females, and then a comparison of these different females. Such a correlation of males and females awaits the capture of the opposite sexes in the same nest, in coitu, or under extremely favorable circumstances for their association. Here is an instance where biological studies are badly needed to aid the systematist.

EXPLANATION OF PLATES

Plate V

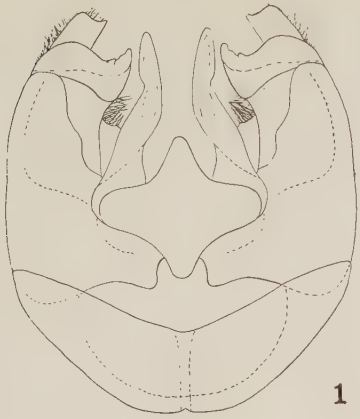
Drawn to same scale.

1. *Bremus solus* (Franklin), genitalia, dorsal aspect.
2. *Bremus kohli* (Cockerell), genitalia, dorsal aspect.
3. *Bremus weisi* (Friese), genitalia, dorsal aspect.
4. *Psithyrus mysticus* new species, genitalia, dorsal aspect.
5. *Bremus steindachneri* (Handlirsch), genitalia, dorsal aspect.
6. *Bremus rohweri* new species, genitalia, dorsal aspect.
7. *Bremus opifex* (F. Smith), genitalia, dorsal aspect.

Plate VI

Drawn to same scale.

8. *Bremus weisi* (Friese), inner spatha.
9. *Bremus weisi* (Friese), outer spatha.
10. *Bremus solus* (Franklin), inner spatha.
11. *Bremus solus* (Franklin), outer spatha.
12. *Bremus kohli* (Cockerell), inner spatha.
13. *Bremus kohli* (Cockerell), outer spatha.
14. *Bremus opifex* (F. Smith), inner spatha.
15. *Bremus opifex* (F. Smith), outer spatha.
16. *Bremus rohweri* new species, inner spatha.
17. *Bremus rohweri* new species, outer spatha.
18. *Psithyrus mysticus* new species, inner spatha.
19. *Psithyrus mysticus* new species, outer spatha.
20. *Bremus steindachneri* (Handlirsch), inner spatha.
21. *Bremus steindachneri* (Handlirsch), outer spatha.



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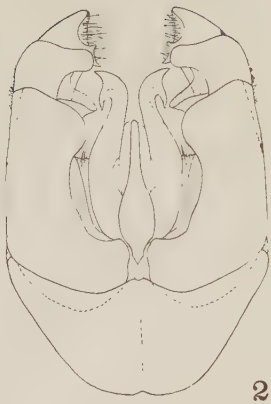

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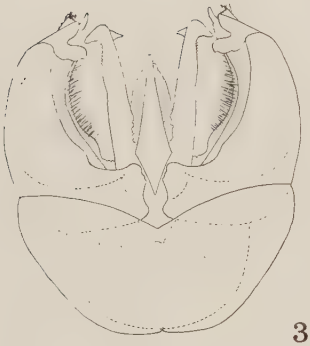

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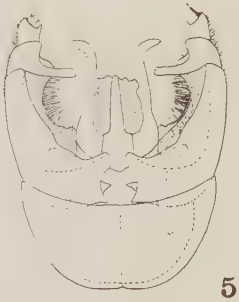

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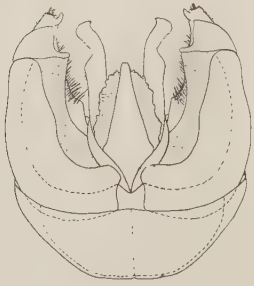

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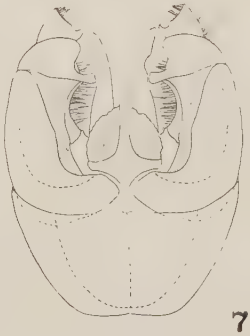

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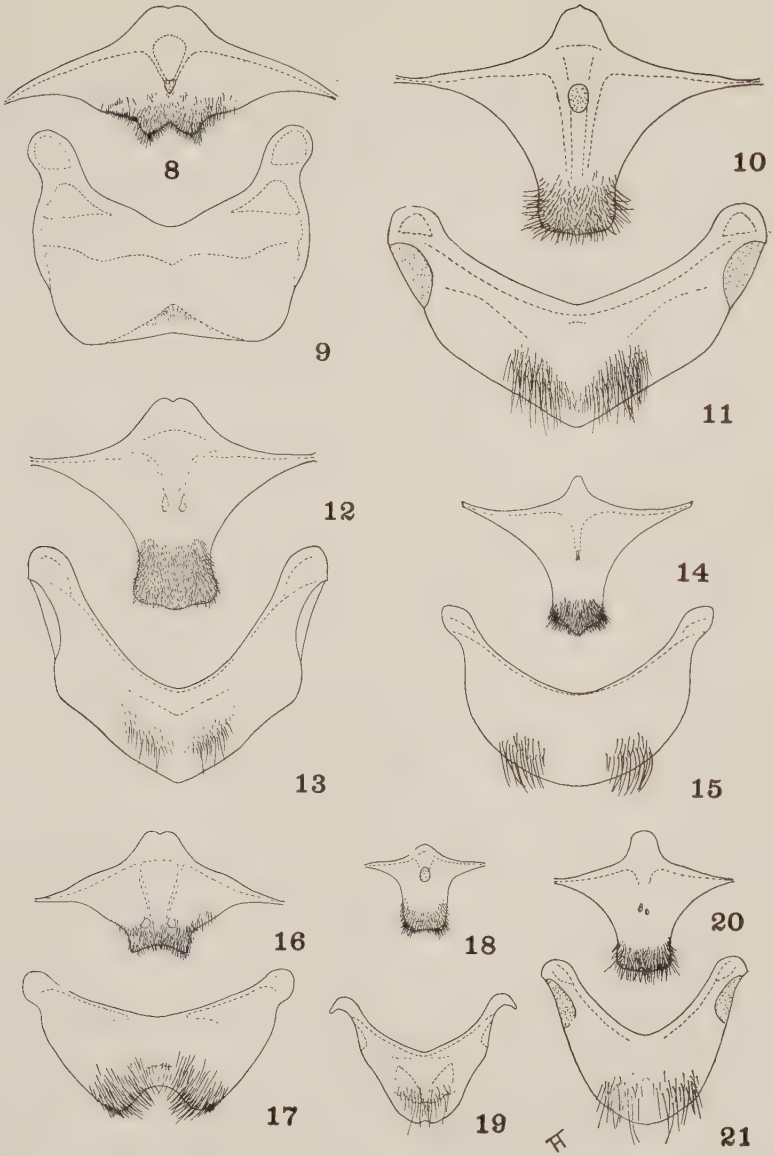
FRISON—NEOTROPICAL BREMIDAE.



FRISON—NEOTROPICAL BREMIDAE.

NOTES ON THE CHRYSOMELIDAE (COLEOPTERA) OF ARIZONA

BY HAROLD R. BRISLEY

The notes given herein have been made from a detailed study of the Chrysomelidae of Arizona covering a continuous period of five years. The species mentioned have been largely studied in the central and south-central parts of the state, where the more exhaustive collecting was done.

The author wishes to express his thanks to Doctor E. C. Van Dyke, of the University of California, for his verification of the insect determinations, and to Mr. Wyatt W. Jones for assistance in plant determinations.

Tribe *Criocerini*

Lema trilineata Olivier

Adults collected from May until August on solanaceous plants, notably potato, tomato and the weed thorn-apple (*Datura meteloides* DC.). Infrequent on cultivated varieties, the greatest injury occurring on the weed above mentioned. Mating and egg laying takes place during April and May, and the first larvae were found full grown on May 9th. Both larvae and adults feed on the leaves, their injury resembling that of the Colorado potato beetle. The insects can commonly be found in the warmer valleys of central Arizona.

Tribe *Clythrini*

Coscinoptera subfasciata LeConte

Adults collected on July 25 and again on September 24, while feeding on the native cat-claw (*Mimosa biuncifera* Bentham), about three miles east of the Cherry Creek Post Office. Generally they are very scarce though at times numerous on individual bushes, where the adults feed on the leaves at tips of the branches. Adults found at elevation of about 4500 feet, which is the upper limit of cat-claw growth. I have never observed them below this elevation.

Coscinoptera species

A much smaller insect than *C. subfasciata.* Collected by sweeping native herbage during June, July and August.

Urodera crucifera Lac.

Adults collected during September from the native cat-claw (*Mimosa biuncifera* Bentham), infested by *Coscinoptera subfasciata,* and feeding in the same manner and at the same elevation as noted for that species. These insects are very rarely found.

Tribe *Chlamydini*

Exema conspersa var. **dispar** Lac.

Numerous in isolated locations on the leaves of the shrub *Hymenoclea monogyra* Torrey and Gray, growing along the borders of streams and dry washes. They are very small and difficult to detect because of their resemblance to the excrement of caterpillars. Where numerous the plants are largely defoliated. The adults fall to the ground readily when disturbed and feign death. The larvae are case bearers and like the adults feed on the leaves, a few being found in conjunction with the adults on April 23. The larvae, when full grown, pupate inside the cases, which are attached to twigs. Collected at an altitude of about 2500 feet on April 23 near Canyon, and on April 24 near Tempe.

Tribe *Cryptocephalini*

Cryptocephalus species

Taken near Camp Verde while sweeping herbage on July 6.

Pachybrachys species

Taken while sweeping herbage on April 3 and 23, May 16, June 6, 8, 11 and 12, and July 25, in the Verde and Skull Valleys.

Tribe *Eumolpini*

Glyptoscelis squamulata Cr.

During May and June adults were taken singly from wild grape (*Vitis arizonica* Engelman), barley, roses and native weeds in the central and south-central parts of the state. I have found overwintering adults beginning to feed on the leaves as early as April 7. The beetles are too few to cause economic injury, as generally only one individual is found on a plant.

Chrysochus cobaltinus LeConte

Collected throughout central Arizona from dogbane (*Apocynum viride* Wooton and Standley) which grows on damp ground and along irrigation ditches. Adults feed on the foliage and when numerous greatly retard the leaf surface. Collected on June 21 near Camp Verde, and on August 20 near Skull Valley. The adults were found mating on June 21.

Colaspis brunnea Fabricius

Occurs on numerous wild and cultivated plants, most notable of the latter being potatoes, beans, strawberries, watermelons, okra, roses, plums, pears and apples. Of the native plants I have taken the adults from wild hop (*Humulus lupulus neomexicanus* Nelson and Cockerell), willow (*Salix* species), Virginia creeper (*Parthenocissus vitacea* (Knerr.) Hitchcock), and *Oenothera hookeri* Torrey and Gray. The insects are found throughout the state and are one of the most economically important leaf-eating beetles of Arizona. They are especially destructive because they are present throughout the summer from June until November. They are voracious feeders, making punctures quite distinctive of the species. These are generally oval, being two to three mm. wide and twice as long, and cut entirely through the leaf. The leaves are seldom entirely destroyed, but often riddled with holes which merge into each other leaving only a green network of tissue.

Colaspis brunnea var. **viriditincta** Fabricius

This variety is scarce, it having been collected in only one restricted area on July 21, at Clemenceau. The insects were feeding on nasturtiums, making the same marks as noted above for *Colaspis brunnea.*

Tribe *Chrysomelini*

Leptinotarsa decimlineata Say

Both larvae and adults are very numerous and destructive especially to potatoes, but also to tomatoes and egg plants from May 17 until frost. In the warmer districts the females start egg laying about the first of May. In some locations where little control is practiced, crops are often completely destroyed. Though a native of Colorado, Arizona was one

of the most recent states to become infested, and there are still isolated locations where the insect is not found.

Leptinotarsa lineolata Stål

Very numerous throughout the state on *Hymenoclea monogyra* Torrey and Gray, bordering streams and sandy washes. The eggs are laid on the leaves during the latter part of May and the first of June. Larvae are found from the first of June until October and like the adults feed on the foliage. Though smaller, the larvae resemble in shape the young of the Colorado potato beetle (*Leptinotarsa decimlineata*), but are striped with black transversely across the body. The adults are found from May until frost. In a single instance I noted potato and tomato plants heavily infested by larvae and adults. They had evidently migrated from the *Hymenoclea monogyra* growing near by, whose leaves were mostly gone, due to the ravages of the insects. Being unable to obtain their native food, which all observations indicate they prefer, they had gone to the potatoes. This is the only instance where I have observed damage to other than wild plants, though I have many times examined potatoes growing near heavily infested *Hymenoclea* beds.

Zygogramma exclamationis Fabricius

The larvae are commonly seen in the growing buds of sunflowers (*Helianthus petiolaris* Nuttall). They eat the newly formed leaves as they unfold, so that when the plant is full grown it is without about half its leaf surface. Never do they destroy the bud, but eat only the very young leaves as they unfold, thus insuring a future food supply. Larvae are common though not numerous, while the adults are somewhat hard to find. Usually the adults are found resting and mating on sunflower leaves during mid-summer in somewhat scattered locations. The specimens on hand were collected on farms bordering Clear Creek, near Camp Verde.

Zygogramma tortuosa Rogers

Adults collected on farms near Cottonwood, while sweeping native vegetation along the irrigation ditches on June 23 and 26. Specimens were also taken at Skull Valley on September 19. They are rarely seen.

Zygogramma suturalis Fabricius

A single specimen only collected while sweeping native vegetation on farms near Skull Valley on August 21.

Zygogramma species

A single specimen collected on September 10, at Skull Valley from the wild plant *Anoda lavaterioides* Medic.

Calligrapha serpentina Rogers

These insects are rarely seen. Specimens were taken in Skull Valley on September 10 while feeding on the leaves of the weed *Sphaeralcea* species.

Gastroidea cyanea Melsheimer

Very numerous on dock (*Rumex hymenosepalus* Torrey) at altitudes below 4500 feet elevation. They are found only during the early spring, as the food plant dries up when warm summer weather begins. Eggs are deposited on the leaves during March and larvae and adults may be found during April, May and June. The work is characteristic in that the beetles and larvae eat only part way through the leaf, leaving the under epidermis intact. When numerous they destroy all the leaf with the exception of the mid-vein, and entire plants are often completely defoliated. The growth of the larva and its transformation to the adult is comparatively rapid. Pupation takes place in the ground near the base of the plants and the adults are often found during the day hiding between clods and in soil cracks, just under the surface of the ground. The specimens on hand were collected near Cottonwood on April 24 and near Skull Valley on May 15.

Lina arizonae Cr.

Common throughout the state on several species of willow (*Salix*) and occasionally seen on cottonwoods (*Populus wislizeni* (S. Wats.) Sargent). The eggs, in groups of ten to twenty-eight, are deposited on the under surface of the leaves during early June. Upon emergence the larvae feed entirely on the under surface of the leaves, leaving the upper epidermis and veins intact, often removing all the green tissue. When full grown the larvae attach themselves to the leaf and pupate, at this stage greatly resembling the lady-bird pupae. In the warmer farming districts of the state, where shade is a very necessary factor to comfort as well as profit, the insects present a problem of severe

economic importance. In the Salt River Valley, the willows are usually completely defoliated and brown by the first of October. Adults may be found from June until frost, but are most numerous during July and August. The greater part of the injury to the foliage is done by the larvae. Adults were collected near Cornville on September 19, near Skull Valley on June 15, and in the Salt River Valley on October 27. On the first two dates eggs, larvae and pupae were also present.

Tribe *Galerucini*

Trirhabda nigrohumeralis Schaet.

A few adults collected while feeding on the native weed *Brickellia* species, near the Shea Mine in the vicinity of Jerome on July 25 at an altitude of about five thousand feet, and again near Camp Verde during August at about three thousand feet elevation. Near the Shea Mine larvae were numerous over a limited area during July, August and September, though the adults were scarce at all times. The larvae are voracious feeders and destroy much of the tender foliage at the tips of the shoots.

Monoxia sordida LeConte

Both the larvae and adults are common and destructive to the snakeweed (*Gutierrezia sarothrae* (Purch.) Britton and Rusby). The work of the larvae and adults is equally severe, completely destroying the foliage in some badly infested areas. A badly infested area occurs about a mile south of Camp Verde, where adults and larvae were collected on June 16. Adults were found to be numerous as late as September, though at this time few larvae were present. Up to the present time, the insects have only been observed on the plant above mentioned. The snake weed is fast taking the place of grass on the over-stocked ranges of Arizona and is of no value as stock food. If it is true that the beetles feed on no other vegetation in this locality, they could well be classed as beneficial.

Monoxia consputa LeConte

Adults common on *Licium pallidum* Miers, growing along desert washes north of Phoenix on April 23, and a few straggling adults collected from the same plant near Cottonwood on May 3 and 20. I have never found the insects numerous enough to materially affect the growth of the plant.

Diabrotica 12-punctata Olivier

Very common and destructive throughout the state to the foliage of numerous vegetables, the most notable being cantaloupe, bean, beet, corn, cucumber, egg plant, grape, lettuce, parsnip, potato, squash, tomato and watermelon. They are most often seen feeding on the pollen of the flowers of the Cucurbitaceae and corn. The adults may be found from April until November, but the larvae are never seen unless the plants are up-rooted, as they feed on the underground parts of corn and both wild and cultivated grasses. The specimens in hand were collected in the Verde Valley on July 15, in the Salt River Valley on October 27 and in Skull Valley on September 19.

Note.—There are instances in state literature where *Diabrotica soror* LeConte has been reported from Arizona. I am firmly convinced that this is incorrect. The markings of the two species are very much the same, but they are clearly distinguished by *12-punctata* having the abdomen and base of femora pale, while *soror* is black beneath and has larger and more often converged elytral spots.

Diabrotica vittata Fabricius

Common throughout the state from June until frost. They are especially destructive to cucurbits where the adults feed on both the stems and the leaves. Early summer injury is done by the adults feeding on the stems of young seedlings, just above the surface of the ground. The larvae live in the soil and feed on the roots of plants. Several times my attention has been called to damage done to the rind of watermelons and honey-dew melons, where they were in contact with the ground. Here the beetles work in colonies, as many as a hundred or more feeding on a single melon. It seems that when once a melon rind is attacked, other beetles are attracted to it, so here they congregate and feed outward from the point where it was first broken, thus the green rind is stripped from the melon, leaving a somewhat rough whitened surface, often six inches square, greatly disfiguring the fruit when it is placed on the market. Where injury of this sort is found, not every melon is attacked, but only scattered individuals.

Diabrotica tricinctata Say

Infrequently found feeding on the leaves of cucurbits and corn. On one occasion an isolated, late patch of corn was found to have the leaves seriously damaged by them. The insects are generally found singly or in pairs, feeding on the pollen and petals of squash, watermelon, cucumber and muskmelon flowers. Adults collected near Aultman on September 3, and near Camp Verde on September 15.

Diabrotica filicornis Horn

About as common and destructive during July and August, and with about the same habits as *Diabrotica 12-punctata*, with the exception that they do not appear as early in the season. The adults feed on a large number of crops, the most important being watermelon, squash, lettuce, cucumber, muskmelon, bean and corn. Feeding is done on the leaves and stems as well as the pollen and petals of the flowers. They seem to be particularly fond of the pollen of flowers of the wild gourd (*Cucurbita foetidissima* H. B. K.). Adults were collected near Cottonwood on July 15 and August 15, and the insects have been observed over central and south-central Arizona.

Diabrotica virgifera LeConte

Adults were taken near Montezuma's Well on Beaver Creek, from squash flowers on June 20, where they were feeding in large numbers on the pollen and petals. Also collected at the same place and time from flowers of the wild gourd (*Cucurbita foetidissima* H. B. K.).

Diabrotica balteata Lac.

Insects usually found singly or in pairs feeding on the pollen and petals of squash, cantaloupe, cucumber, wild gourd (*Cucurbita foetidissima* H. B. K.), watermelon and on corn leaves and pollen. Adults collected near Camp Verde on August 1 and in the Salt River Valley on October 27. Occasionally seen from June until November.

Luperodes varipes LeConte

A single specimen only was collected near Cornville on July 15 from rhubarb, where it was plainly feeding on the leaves.

Halticidea placida Horn

Adults taken at intervals during the summer in Skull Valley and the Verde Valley, while feeding on the leaves of the wild cascara (*Rhamnus californica tomentella*). Coleopterous larvae have always been found mining in the leaves where the adults occur, which may mean a connection. Efforts to rear adults have been unsuccessful.

Tribe *Halticini*

Oedionychis species

A single specimen only collected from ash (*Fraxinus attenuata* Jones), bordering a dry wash in the mountains west of the Verde River on May 26.

Disonycha carolina Fabricius

Common and numerous in the central and south-central parts of the state. Adults feed on the round, spiny leaves of the wild aster (*Aster spinosus* Bentham). They strip off a thin layer of the outer tissue, making a scar one mm. wide, and from one to six cm. long. Even where found to be numerous, they do not kill the leaves, as the feeding scars run length-wise and do not girdle them. Adults were taken on July 6 from bushes growing along irrigation ditches near Cornville. The adults may be found from the middle of June until October. After this time they seem to disappear, even though the plants still remain green for at least a month longer.

Disonycha politula Horn

Common throughout the state on species of pig weed (*Amaranthus*), especially *A. palmeri* S. Watson. The adults eat round holes through the leaves but seldom cause complete destruction of the plant. The adults are found from July until October.

Longitarsus nitidellus Cockerell

Taken from an unknown weed growing along a dry wash in the hills west of the Verde River near Cottonwood. They were quite numerous on plants in this locality

Phyllotreta pusila Horn

Very destructive to young cruciferous plants especially cabbage, often completely destroying young seedlings in the

field and hot bed. After the plants are transplanted the injury still continues, but the plants are then large enough to resist the usual attack, though I have occasionally seen plants killed after transplanting. The insects also thrive on the native beeweed (*Cleome lutea* var. *jonesii* Macbr.), often completely riddling its leaves with their round feeding holes. After much of the leaf tissue has been consumed they feed on the main veins and younger stems. During the latter part of April, May and early June they are most numerous, attacking the young plants just as they come through the ground. After the plants are older the flea-beetles are seldom seen, and the feeding marks are inconspicuous. Adults were taken near Cottonwood on May 14.

Phyllotreta lewisii Cr.

Collected from radishes near Prescott on April 21, where they were doing a considerable amount of damage. The plants were young, having only their first pair of true leaves. The beetles had already killed enough plants to thin out the bed.

Phyllotreta albionica LeConte

Numerous in central Arizona on cruciferous plants, but especially damaging to turnip, radish and cabbage. Adults were collected near Aultman on April 15 from turnips.

Haltica obliterata LeConte

Common in many sections on grape and the native weed *Gaura parviflora* Dougl., growing in the waste parts of cultivated fields. Adult beetles were collected near Aultman on May 26 and in the Salt River Valley on April 24. The insects are found from the first of May until early September. The eggs are laid on the under side of the *Gaura* leaves early in the spring, and upon hatching the young larvae feed on this surface eating only through to the upper epidermis which is left intact. The work of the adults differ in that they eat a hole entirely through the leaf. I have never seen the larvae feeding on grape leaves, though damage by adults is common.

Haltica vialis Fall

Found associated with *H. obliterata*, from which species it is not readily separated.

Blepharida rhois Forst.

A single adult was taken from squaw bush (*Rhus trilobata* Nuttall) near Cornville on April 16. Larvae were numerous on a single bush, while others adjoining showed no infestation. The larvae feed at the tips of the new growth on the leaves as they unfold from the bud. Nine shoots on the one bush showed conspicuous damage. Ten days later no insects could be found on the same plant. Examinations at intervals throughout the season did not reveal any later infestation of the same bush.

Chaetocnema ectypa Horn

This is probably the most destructive Chrysomelid of Arizona. It occurs in all sections of the state except at the higher altitudes. I have never found them numerous enough to do any material damage at altitudes above four thousand feet. On account of their small size and agility when disturbed, they are seldom blamed by untrained persons for the white marks which appear on the blades of corn. Farmers most often refer to the scars as being caused by high winds, sunscald and almost every other agent except the right one. Their feeding marks are very unusual for insects of this group, being about one mm. wide and from one to two cm. long, depending on the length of time the insect remains in one place without being disturbed. When they start eating, they generally begin in an entirely new place, and do not continue in an old location. They prefer the younger leaves and feed either on the upper or lower surfaces, making scars cut only part way through the leaf. They are most destructive to corn when it has only one to three leaves, at which time the plants are often killed. When the corn is young, there is little other vegetation on which to feed and the insects gather on the young corn which is at the most critical stage for injury. Later in the season they can be found in the folded leaves at the top of the plants, and when the leaf finally unfolds it is disfigured by numerous white scars. Sweet corn and corn planted early in the season is especially subject to injury. They feed also on sudan grass, and at times I have observed slight injury to young barley and oats. Johnson grass (*Holcus halepensis* L.) is a common food plant early in the spring, but they leave it when corn becomes available.

Epitrix parvula Fabricius

Common throughout Arizona on solanaceous plants, especially potato, tomato and egg plant. The native plants most commonly infested are thorn apple (*Datura meteloides* DC.), ground cherry (*Physalis wrightii* A. Gray and *P. fendleri* A. Gray), trompillo (*Solanum elaeagnifolium* Cav.) and *Licium pallidum* Miers. The beetles are especially injurious to tomatoes and egg plant in the seed bed, where the over-wintering adults find their way on the first warm days of spring. Instances are common where the young plants are eaten off as soon as they appear above the ground. Whole seed beds are often rendered useless for transplanting, while young plants transplanted into the field are frequently injured or killed. The injury to egg plant can often be seen well into the growing season. When tomato plants once get a good start they easily grow out of the injury. In some instances the growth of early potatoes is greatly retarded, but being a sturdier plant than the tomato the injury is seldom fatal. Adults were collected from potato near Camp Verde on June 5, and from thorn apple (*Datura meteloides* DC.) near Cottonwood on June 6. The injury is in the form of very small, roundish, or slightly irregular shaped holes, eaten entirely through the leaves.

Mantura floridana Crotch

Found only on dock (*Rumex hymenocephalus* Torrey) in somewhat limited locations. Where present they are usually extremely numerous, often entirely destroying the leaves. The larvae can readily be found as they are leaf miners, living on the green tissue between the lower and upper epidermis. The pupal stage is reached inside the mines, from which they emerge as adults. No other plant seems to be attacked. The adults on hand were collected near Aultman on May 18, and adults and larvae were taken near Sedona on May 26.

Systena pallida Boh.

Common in the Verde Valley on sunflower (*Helianthus petiolaris* Nuttall), water willow (*Baccharis glutinosa* Pers.), fleabane (*Leptilon canadense* (L.) Britton), cocklebur (*Xanthium commune* Britton) and wormwood (*Artemisia* species), all plants being attacked with about the same severity. The adults appear

during early June and continue throughout the season. On many occasions, very pronounced injury has been observed. Adults were collected near Cornville on June 23, and near Camp Verde on June 26.

Systena taeneata Say

Found in the same localities and on the same food plants as *S. pallida* though not nearly as numerous. The work of the two is indistinguishable, both making elongate feeding marks two mm. wide and up to one cm. long. The feeding is done entirely on the leaves. Adults were collected near Camp Verde on June 26.

Systena taeneata var. **ochracea** LeConte

Collected in the Verde Valley on June 10, feeding on the same food plants as *S. pallida*.

Psylliodes convexior LeConte

Taken from lettuce in a garden near Prescott on June 15, where they were causing no little damage. This garden is at an altitude of five thousand three hundred feet.

Tribe *Hispini*

Microrhopala rubro-lineata var. **vulnerata** Horn

Larvae found mining the leaves of goldenrod (*Solidago californicus*) at an elevation of about seven thousand three hundred feet at the summit of Mount Mingus near Jerome on August 28. After a diligent search I collected only a single adult. After several days inhabited mines brought into the laboratory and kept damp yielded several more adults. Pupation takes place inside the mine and after emergence the adults feed on the same plant. Considering the size of the beetles, the mines are quite large. Very few of the mines found on the date mentioned were inhabited. I have not found this species elsewhere.

Octotoma marginicollis Horn

Collected in three somewhat restricted locations along Oak Creek from Cornville to Sedona. The larvae are leaf miners of the native plant *Perezia thurberi* A. Gray. The plant has large leaves and I have found as many as six mines in a single leaf. As the larvae grow the mines become confluent and the leaf

is generally entirely mined out before pupation takes place. The insect goes through a short pupation period in the mine, and after emergence the adults feed on the leaves of the same plant. Full grown larvae and pupae readily yielded adults after having been kept in a damp jar for several days. Larvae, pupae and adults were all found on the leaves at the same time. The adults may be collected from June until October. On September 14, I found adults feeding on ash (*Fraxinus attenuata* Jones) near Sedona, though I was unable to find any larval mines in the leaves of that plant. In one location near Cornville, the insects have been observed for the last five years.

Stenopodius flavidus Horn

I collected small, inconspicuous mines containing live larvae and pupae from the weed *Sphaeralcea grossulariaefolia* Rydberg, growing along the white lime hills east of the Verde River between Cornville and Camp Verde on April 9 and September 13. The food plant is common, but only scattered individuals have mines. The work of the larvae is hardly discernible because of the smallness, thickness and hairyness of the leaves. They are generally found in the older leaves near, or resting on the ground, and the mines are relatively small considering the size of the larvae. On April 9, I collected several adults, and leaves containing pupae, brought into the laboratory, yielded more within a few days.

Baliosis californicus Horn

Beetles were hatched from pupae, collected in mined leaves of buckthorn (*Ceanothus fendleri* A. Gray) at an elevation of about six thousand feet near Prescott on August 21. Some clumps of bushes contained numerous mined leaves, while others adjacent appear to be entirely free from infestation. The leaves of the host plant are very small and thick, yet the leaves are rarely, if ever, entirely mined out. Adults can readily be secured from pupae after keeping in a damp place for a few days.

Chalepus ater Weiss.

Larvae and pupae in mined leaves of the common field bean, brought to this laboratory by Mr. Wyatt W. Jones, two days after collecting in the Sulphur Springs Valley during late August, yielded adults within a very few days. The mines are large,

irregular blotches, slightly larger than those made by *Octotoma marginicollis*. Mr. Jones reports that the mines were common in some locations, though the extent of injury was difficult to determine on account of the usual severe infestation of the lady-bird bean beetle.

Tribe *Cassidini*

Coptocycla emarginata Boh.

Common, though not readily seen on account of their habit of feeding in the shade on the under side of the leaves. The principal damage to cultivated plants and weeds is during the development of the larval stage. After the larva is full grown, it attaches itself to the surface of the leaf and pupates. All stages from egg to adult can be found on the plants during June, July and August, though July and August are the months when damage is most apparent. In central Arizona the sweet potatoes are the most common food plant, and it is important to note that they are well started before the insects become numerous. During August though it is common to see the leaves over large areas completely riddled with feeding holes. Their native food plants are those of the family Convolvulaceae, the most important plant being the wild morning glory (*Ipomoea hirsutula* Jacq.). Adults have been collected in the Verde Valley near Jerome, along Oak Creek near Cornville, near Camp Verde, in Skull Valley and in the Salt River Valley.

Coptocycla signifera Herbst. and **C. signifera** var. **lecontii** Cr.

Not as common as *C. emarginata*, but found in conjunction with that species on the same food plants. I collected adults near Cottonwood from sweet potato on July 15, from morning glory on September 22 near Camp Verde, and from sweet potato on July 8 near Cornville.

Coptocycla clavata Fabricius

This is the most common species of any tortoise beetle here mentioned and is probably the most widely distributed. Both larvae and adults feed on the leaves of peppers and are often numerous enough to cause considerable injury to the plants. The adults are found during June, July and August feeding on the under side of the leaves where it is shady. The larvae

feed on either surface. The adults fly readily when disturbed and for this reason they are not so often seen. The feeding holes for both young and old are about the same shape, though the ones made by the very young larvae are much the smaller. Their natural food plants in Arizona are the thorn apple (*Datura meteloides* DC.), the wild ground cherry (*Physalis wrightii* A. Gray and *Physalis fendleri* A. Gray) and *Solanum douglasii* Dunal. All stages of the life history are found on these plants. I have collected adults from Skull Valley, the Salt River Valley near Phoenix and the Verde Valley near Jerome.

Chelymorpha argus Herbst.

I observed this species on September 3 near Cottonwood feeding on morning glory (*Ipomoea hirsutula* Jacq.), and again on August 26 along Oak Creek near Cornville, feeding on watermelons, cantaloupes and cucumbers. The watermelon leaves were the most severely damaged, being riddled with large ragged holes made by both larvae and adults. Instead of the injury being spread evenly over the field, it was generally confined to areas. While these spots were badly infested with the insects, yet plants twelve feet away were uninjured.

MICROLEPIDOPTERA OF NORTHERN UTAH

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The Microlepidoptera upon which this paper is based were collected in extreme northern Utah, and in adjacent parts of southern Idaho, from June 8 to July 18, in the summer of 1924. With the exception of Bear River Bay, Great Salt Lake, all the localities mentioned may be found on the following U. S. Geological Survey maps: Logan and Randolph quadrangles, Utah; Preston and Montpelier quadrangles, Idaho.

Headquarters during this time were made at the Utah Agricultural College, Logan. In this connection, I wish to thank the Utah Agricultural College, and especially Dr. I. M. Hawley, of the Department of Zoology, for the many courtesies extended, and for the use of the laboratory facilities, without which, the reared material, which forms the most valuable part of the collection, could not have been secured.

Logan is situated on the east side of Cache Valley, a boulder-filled valley, part of the former bed of Lake Bonneville; this valley is hemmed in by ranges of the Wasatch Mountains, which rise abruptly from the floor of the valley where the altitude varies from about forty-five hundred to five thousand feet, to altitudes approaching ten thousand feet. The mountains are cut by east-west canyons, of which the principal one is Logan Canyon.

The valley receives an annual rainfall of somewhat less than sixteen inches, and except where under irrigation, or on the marshy lands along Bear River and its tributaries, the vegetation is largely sagebrush with its accompanying herbaceous perennials.

The gravel benches or lake terraces and lower south and west slopes of the mountains are similarly largely sagebrush, with scattered juniper and mountain mahogany a little higher up. It is only on sheltered slopes of general northerly or easterly exposure that evergreen forest is found; and here it only reaches any degree of development in more sheltered valleys or at higher

altitudes. At the higher altitudes in much the same situations as the spruce-fir forest are montane meadows, with a rich herbaceous growth of many species.

Slope exposure is the most important ecological factor in this region. On exposed southern slopes sagebrush covers the mountain sides up to the highest altitudes. A sudden change of exposure on a mountain side is often marked by a sharp vegetation line; for example, along the crest of a narrow ridge the sagebrush of the south slope may meet and mingle with branches of Douglas fir projecting across the ridge from the forest of the steep north slope. Again, on the slopes of Logan Peak, at nine thousand feet, the Engelmann spruce-fir forest of a northeast slope casts its shadow across a shallow ravine onto the sagebrush of the southwest slope.

It is obvious that in such a region, "locality" even with the altitude, gives very little idea of the habitat, and is of correspondingly little help in rediscovering a species. For this reason, the habitat is given under each species, unless, as in many cases, the food plant itself indicates the habitat.

In the next few paragraphs, the principal habitats in which more or less extensive collections were made and the general character of the Microlepidopterous fauna are briefly described, with a list of the more characteristic groups or species found.

The gravel benches or terraces and the south and west-facing slopes of the mountains, especially at the lower altitudes, where the dominant vegetation is sagebrush with herbaceous perennials, and, a little higher up, with groups of junipers and mountain mahogany, is especially rich in species of the genus *Bucculatrix*. Almost all of the species in this genus collected in the region were found in the sagebrush association or in the transition mixed sagebrush, shrub, Douglas fir community on the lower, less exposed north, northeast or northwest-facing slopes. The Eucosminae are represented by a large number of species; of these the commonest and most characteristic species is *Eucosma argentialbana*. Other common Lepidoptera here are *Choreutis gemmalis*, *Agonopteryx umbraticostella*, and *Adaina cinerascens*, all belonging to balsam-root, one of the characteristic plants of the sagebrush; *Platyptilia fragilis* in seed capsules of *Pentstemon cyananthus*. Grasshoppers are very common. With few excep-

tions, such as *Choreutis* and *Heliodines*, the species of this habitat exhibit the characteristic desert coloration—buff, sandy, pale or reddish gray, with fine mottling.

In the eroded gullies of these same slopes, where there is abundant ground water, there is a growth consisting principally of maple with choke cherry and other shrubs, even at the lower altitudes at the base of the mountains; and some species belonging to these plants are found here, such as *Gracilaria acerifoliella* on the maple, and the extremely abundant *Cacoecia cerasivorana* on choke cherry.

At the lower altitudes, on the steep slopes of general northerly exposure, although the sagebrush association still persists to a large extent in the less sheltered situations, a transition vegetation community is found. On the lower part of these slopes there mingle with the sagebrush a great variety of shrubby plants, among them two species of mountain mahogany, service-berry, choke cherry, and currant, with scattered juniper a little higher up, some other shrubs, such as *Ceanothus*, *Pachystima*, and *Physocarpus* form a dense tangle in some places, while in others there are groups of small Douglas fir; occasionally a few aspens occur in these situations. There is corresponding change and greater variety in the herbaceous vegetation. As may be expected this transition vegetation community is particularly rich in species of Lepidoptera, as it brings together within a space of a few feet most of the species of the sagebrush association and some of those strictly belonging to the evergreen forest, such as *Argyresthia monochromella* and *Chalceopla discalis*, as well as those species belonging to the shrubs characteristic of this transition community. The gullies on these north slopes are lined with maples, but here two species of *Lithocolletis* occur which are not found on the maples in the more exposed gullies of the lower west slopes. The shrubs of this transition plant community support an unusually large number of species and individuals of Microlepidoptera. On service-berry (*Amelanchier alnifolia*) alone, the larvae of seven species were found; often the greater number of the leaves of mountain mahogany (*Cercocarpus parvifolius*) are sewed together by larvae of *Peronea foliana;* the sagebrush is nearly defoliated by the larvae of *Gelechia trilineella;* large colonies of *Cacoecia cerasivorana* enclose

the twigs of choke cherry with their webs; a little higher up *Bucculatrix pomifoliella* is especially common on *Physocarpus*. The herbaceous plants also yield a number of species, probably the most common being *Sparganothis distincta* on *Solidago* species, at the edges of the groups of Douglas fir.

Of a total of one hundred and thirteen species of Microlepidoptera recorded in the following pages, sixty-six can be assigned to the sagebrush association or to this transition community.

Among other habitats which may be mentioned are the aspen groves, usually occurring at altitudes between sixty-five hundred and seventy-five hundred feet, depending on exposure, but never on south or west slopes, unless in very sheltered situations. *Choreutis occidentella, Isophrictis occidentalis* among the cone-flowers, aspen-feeding species, such as *Phyllocnistis populiella*, and several species of tortricids are found. *Gnophaela latipennis vermiculata* may be seen by the hundreds on the flowers of a tall *Senecio*.

What little collecting was done in the spruce-fir forest of the higher altitudes, indicates that here as in other regions, this habitat is the poorest of all in species of Lepidoptera.

The montane meadows of the higher altitudes, such as the meadow around Tony Grove Lake, are characterized principally by phalonids, pyralids, and pterophorids in considerable numbers, and some tortricids, of which *Cnephasia argentana* is perhaps the commonest.

In the marshy areas, principally in Cache Valley, and in the vicinity of Bear Lake, crambids are the characteristic Lepidoptera, and a number of species, mostly common and of wide geographical range, were taken. In one such locality, *Glyphipteryx californiae* was extremely common.

On the alkali flats of St. Charles, Idaho, near Bear Lake, *Gnorimoschema consueta* was the characteristic and common species, and except for a very few specimens of other species, the only microlepidopteron seen at the time.

Within the region, the distribution of a species is generally coincident with that of its food plant, but several striking exceptions were noticed. For example, although *Cacoecia cerasivorana* infests choke cherry everywhere, *Gracilaria melanocarpae* occurs on this plant only at the higher altitudes.

A very remarkable seasonal effect of even a slight increase in altitude was observed; this is especially marked at a thousand feet or more above the floor of the narrow east-west canyons, which receive the full effects of the heat of the sun from early morning on. More sheltered habitats, farther back in the mountain range, and away from the influence of the heat and dryness of the boulder-filled valley, although similarly situated and at the same altitudes, and apparently, vegetationally at least, ecologically equivalent to habitats nearer the edge of the range, show a marked seasonal retardation, amounting to a week or ten days.

A comparison of recorded geographical distribution with habitat distribution as worked out in this region is interesting. Those species of Microlepidoptera which have a recorded southern geographical range or are species of lower altitudes (as indicated by the localities where they have been collected) are chiefly species of the sagebrush and transition communities; those reported from more northern localities are chiefly species which in this region belong to the evergreen forest and montane meadows of the higher altitudes and more sheltered situations. In other words, the distribution of species is not geographical or altitudinal, but is determined by vegetation areas.

The more extensive collections were made in the sagebrush and transition communities, and are doubtless more representative of the microlepidopterous fauna of their habitats than are the collections made in other less accessible habitats. The unusually dry winter, spring, and early summer of 1924 probably exerted an appreciable effect on both number of species and individuals, especially in the lower drier localities.

Unless otherwise expressly stated, the types and paratypes of the new species described in this paper are in the writer's collection.

Only references to papers published subsequent to Dyar's List are cited under the species; for the earlier references, the reader is referred to Dyar's List. For all references to the Eucosminae, Heinrich's recent monograph of that subfamily should be consulted.

Cosmopterygidae

Psacaphora communis new species

Palpi black, with numerous more or less regular narrow white annulations. Antennae dark fuscous, with paler fuscous annulations, which are twice as far apart and whitish in the apical third. Face yellowish white, head and thorax brownish fuscous, without metallic luster. Basal fifth of fore wing brownish fuscous, black beyond, with the apical fifth minutely dotted with white. At basal fourth, two oblique white streaks, the outer one short, the inner one acutely angled on the fold and joining below the fold a whitish spot on the dorsum, dusted with fuscous and brownish ocherous scales. Beyond the middle, a second pair of oblique costal spots, white on the costa, shading to brownish ocherous below. Opposite the first of these a whitish dorsal spot. At apical fifth there is an angulated bluish metallic mark, with apex pointing outward; it does not reach either margin; on the costa above it a small white triangular spot. Two curved parallel bluish metallic lines around the apex; the outer one broken and indistinct except on costa. A large blackish scale tuft below the fold before the middle of the wing is edged inwardly by a few metallic scales; a second scale tuft beyond the middle lies just posterior to the second dorsal white spot, its metallic inner edge running up between the brownish ends of the second pair of costal spots. Hind-wings gray. Legs black, with transverse white bars, the hind tibiae with three such bars. Expanse: 7–10 mm.

Type (♂) and eighteen *paratypes* (♂ and ♀) reared from miners of leaves of fireweed, *Chamaenerion angustifolium*, collected in Spring Hollow, altitude 5500 feet, July 18. Two paratypes have been placed in the Academy of Natural Sciences of Philadelphia. The reddish larva makes a single long, much contorted, pale greenish transparent linear mine, folding back and forth parallel to itself, and gradually increasing in breadth. Cocoon of rather dense white silk. Two specimens emerged August 30 and September 2 respectively, the rest remaining in the pupal state until spring and emerging from April 11 to April 27.

Gelechiidae

Isophrictis occidentalis new species

Palpi white, with brownish gray dusting and brownish hairs mingled with the white in the brush; antennae white with gray annulations. Head and thorax whitish with fawn and brownish dusting. Fore wings dull ocherous, marked with streaks of

white-tipped scales. A border of these white-tipped scales extends around the margin of the wing from base of costa to the middle of the dorsum. On the disk, three longitudinal streaks from the base, to about the middle of the wing, one just below costa, a second, the longest, just above the fold, the third below the fold. A small spot of white-tipped scales at the end of the cell. Cilia grayish, the first line of scales in the cilia concave opposite the apex. Hind wings and cilia gray. Legs whitish, hind tibiae ocherous. Expanse: 17–18 mm.

Type (♂), and four *paratypes* (3 ♂, 1 ♀), Tony Grove Creek, 7000 feet, in aspen groves, flying amongst *Rudbeckia occidentalis*, in the heads of which the larvae probably feed.

This species differs from *I. similiella* Chambers in the larger size, more ocherous color, and the fact that the longitudinal streaks of white-tipped scales are confined to the basal half of the wing.

Aristotelia amelanchierella new species

Head brown, pinkish on the face. Palpi brown; a broad band at base, another at middle, and extreme tip of second segment pink; third segment black, with a broad pink band just beyond base, and two whitish spots on upper side, the second just before apex. Thorax brown, a pinkish streak on each side of the middle. Ground color of the fore wings whitish, densely dusted with fuscous; the apical fourth and the wing below the fold, and sometimes the entire wing, suffused with pink. Markings nearly as in *roseosuffusella;* a dark brown oblique acute triangle from near base of costa projects its apex below fold; an oblique dark brown bar from basal third of costa to fold sends from its lower outer corner a narrow arm outward and upward, which often joins the middle of the inner side of a half-elliptical brown patch at two-thirds of costa. The patch of ground color thus enclosed is the most densely dusted on the wing. From the lower side of each of these three dark marks, a brownish ocherous often undusted shade continues in the same direction to the dorsum. The third brown patch is separated from a fourth brown patch before apex by a pink costal patch, below which is an indistinct short longitudinal black line in the middle of the wing. Apical third of wing, except for the fourth brown patch, strongly suffused with pink and shaded with brownish ocherous just beyond tornus. Hind wings gray, cilia faintly brownish. Legs brown, the transverse bars usually pink. Expanse: 10–11 mm.

Type (♂), and seven *paratypes* (♂ and ♀), in the writer's collection; one paratype in the collection of the Academy of

Natural Sciences of Philadelphia. All were reared from larvae on service-berry, *Amelanchier alnifolia*, from slopes of Logan Canyon, near Logan, June 21. The larva spins a web across the upper side of a leaf beneath which it feeds, eating off the upper surface of the leaf. My only note upon the larva is "transversely marked with alternate light and dark bands." Imagoes July 9 and July 14; the date of emergence of the type is July 9.

This species may be distinguished from its close and similarly marked allies by the absence of any defined pale spot at the tornus.

Aristotelia planitia new species

Head light brown; palpi whitish, second segment with a narrow brownish ocherous annulus near base and a second near tip; third segment black at base and tip, a brownish ocherous annulus before middle, and a pale buff annulus beyond middle. Antennae dark fuscous, with paler annulations. Fore wings rich brown or dark brown, more golden, paler and rosy-tinged below the fold and in the apical third. An oblique narrow white fascia from basal fourth shades into the ground color below the fold; a broken line of black scales runs through the middle of the white. A second narrow angulated fascia at middle of the wing, rosy-tinged on costa, is also lost below the fold; from its angle a white spur extends a short distance along the middle of the wing. The usual brown bar preceding the median white fascia is curved, its outer side concave toward costa, and the space between this concavity and the costa is filled with dense brown dusting so that the bar is scarcely differentiated; together with the dusting it forms a large half-oval patch reaching to the fold. At apical fourth of costa an inwardly oblique rosy-tinged triangle. Costal cilia smoky gray; cilia just below apex rosy-tinged, with a smoky gray line through their middle; opposite the rosy costal triangle, a bar of rosy cilia, without the dark line. Hind wings gray, cilia with a golden tint. Legs fuscous-dusted, with whitish bars. Expanse: 13.5–14 mm.

Type (♀), Logan, June 25: *paratype* (♀), July 1, Logan. Larva probably on willow.

This species is closest to *A. fungivorella* Clemens and except for minor differences, the configuration of markings of the fore wing is the same.

Evippe abdita new species

Labial palpi white, basal two-thirds of second segment black on the outer side, base and tip of third segment black. Antennae

fuscous with whitish annulations. Face white; head above white, dusted with dark fuscous. Thorax and fore wings whitish, dusted with dark fuscous; the lightly dusted areas form defined markings, contrasting with the heavily dusted and blackish areas. A lightly dusted irregular stripe runs along the dorsum from base to tornus, at basal third sending a blunt lobe to the fold, before tornus a sharper lobe, and just beyond the tornus ending in an outwardly oblique whitish streak which nearly meets the apex of an outwardly oblique costal streak. Below the fold, just before and behind the blunt lobe of the dorsal stripe, the wing is black. Ill-defined lightly dusted spots at basal fourth and at middle of costa. Cilia whitish. Hind wings and cilia silvery. Legs whitish, tarsi fuscous, except at tips. Expanse: 8.5–9 mm.

Type (♂), and one *paratype* (♂), reared from larvae on *Cercocarpus ledifolius*, Logan, Utah; one *paratype* (♀), Camp Baldy, San Bernardino County, California, July 9.

The larva spins a web, usually beginning at the base of one of the little side shoots and spreading over the underside of one of the larger leaves, then mines into the leaf from beneath the web. Cocoon of thin silk. Larvae collected June 10; the type emerged July 8, paratype July 19.

Veins four and five of the fore wing are short stalked.

Gnorimoschema consueta new species

Palpi buff, with more or less fuscous dusting; apical half of third segment, except extreme tip, blackish. Antennae dark fuscous, paler toward the tip, where they are faintly annulate. Head and middle part of thorax whitish or pale grayish buff, with a median dark gray line; sides of thorax and tegulae blackish fuscous. Fore wings ocherous, sometimes brownish, dorsal margin usually paler; margins of the wings and veins marked with lines of black-tipped white scales, usually narrow, sometimes encroaching on the ground color. Base of costa and a short streak from base below fold, blackish; the latter streak wanting in paler specimens. A round black spot on middle of cell; a larger bar-shaped obliquely placed spot above middle of cell; a comma-shaped mark at end of cell, the dot on the discal vein, the hook curving around the upper angle of the cell. Sometimes on extreme costa at apical third and at tornus, there are faint indications of opposite costal and dorsal spots. A row of blackish dots around apex from costa to tornus. Hind wings pale to dark gray. Legs densely dusted with blackish fuscous. Expanse: 15–17 mm

Type (♂), and thirteen *paratypes* (♂ and ♀) in the writer's collection; one *paratype* in the collection of the Academy of Natural Sciences of Philadelphia.

St. Charles, Idaho, June 28, on alkali flats. This was the commonest lepidopteron flying in that community at this time.

The type specimen shows all the markings enumerated in the above description; the extremes of the series vary from one specimen with pale yellowish ground color and little dark scaling except in the apical fourth, to specimens with brownish ground color almost overlaid with fuscous-tipped scales. The palpal markings and light head and thoracic stripe are constant characters.

Gnorimoschema macromaculata new species

Head white; palpi white, the second segment either merely dotted with a few fuscous specks or shaded with ocherous and more densely dusted; third segment with minute black dusting covering its whole surface or in great part confined to the apical half. Antennae white, with blackish annulations. Fore wings white, more or less overlaid with ocherous or brownish ocherous scales, which form some definite patches; fine black dusting borders the costal margin, and larger black-banded scales are scattered over the wing and clustered on the costa and around apex. An irregular oblique broken ocherous band crosses the wing near base; on the middle and at the end of the cell are large brownish ocherous patches, both usually extending below the fold; the two blackish discal spots, when present, lie at the upper edge of these ocherous patches. Often the discal spots are wanting; sometimes they are large, and in this case, the ocherous patches are reduced in size, and scarcely larger than the discal spots. Plical spot usually absent. An ocherous streak runs from base within the costa. The wing below the fold is more or less overlaid with ocherous, which sometimes connects with the discal patches; the apical fourth of the wing is ocherous. Around the apex, from the beginning of the costal cilia to the tornus, is a series of pure white spots, separated from one another by bars of ocherous and black-banded scales; the first of these on the costa is preceded by a cluster of black-banded scales; sometimes all but the first costal and the tornal white spots are minute or absent. Hind wings whitish, lustrous, with an ocherous tinge toward apex and in the cilia. Legs white with fuscous dusting arranged in transverse bars. Expanse: 14–15 mm.

Type (♀), six *paratypes* (♂ and ♀) in the writer's collection; one *paratype* in the collection of the Academy of Natural Sciences of Philadelphia. A female is chosen as the type because of the tendency of the males to become greasy.

Bear River Bay, Great Salt Lake, Utah, June 14, flying amongst *Scirpus paludosus.*

This species is probably nearest to *G. batanella* Busck, agreeing with it in general character and position of markings. Its general appearance does not at once suggest a *Gnorimoschema,* probably because of the two large conspicuous ocherous discal patches.

Recurvaria crataegella Busck

Common on apple in the orchards.

Stomopteryx nigrella Chambers

One specimen, June 25, Logan, in the sagebrush association. The whitish fascia at apical third is faintly indicated.

Duvita concinusella Chambers

One specimen, July 8, Logan Canyon, about 5500 feet altitude, transition community. Four specimens of this species in my collection show a variation in venation from vein six of the fore wing out of the base of seven, to veins seven and eight out of six; this variation in one case occurs in a single specimen. *Subsimilella* Clemens, placed in *Epithectis* on venational characters, is probably more correctly referred to *Duvita.*

Gelechia fructuaria new species

Head pale yellowish; palpi pale yellowish, second segment dark brown at base, third segment with fuscous scales on the inner side; antennae dark brown. Thorax pale yellowish, tegulae dark brown or blackish. Fore wings dark brown or blackish, with a sprinkling of paler scales in apex; markings pale yellow or whitish. The wing below the fold from base nearly to the tornus pale yellow; a narrow outwardly oblique fascia from near base of costa joins the pale dorsal area on the fold at one-fourth; the end of the pale dorsal area is projected upwards to costa in a gradually narrowing lobe, its edge toward apex straight and nearly perpendicular, its edge toward base oblique. There is thus enclosed between it and the narrow basal fascia a triangle of ground color which is marked on the costa by a yellow oval or triangle. At three-fourths a yellowish fascia not quite

reaching tornus, is deeply indented on its inner side and sometimes broken in the middle. Cilia of the general ground color with a sprinkling of paler scales. Hind wings pale gray, shading darker outwardly, with darker cilia. Legs whitish, dusted with fuscous except on the hind tibiae. Expanse: 13–15 mm.

Type (♂), and seven *paratypes* (♂ and ♀), Olancha, Inyo County, California, June 19; one *paratype* (♂), Cache Valley near Logan, Utah, June 16. One *paratype* deposited in the collection of the Academy of Natural Sciences of Philadelphia.

The specimen from Logan, Utah, was taken flying in a patch of sagebrush and lupines.

This species is closest to *G. chloroschema* Meyrick; in *G. fructuaria* the dorsal pale area is separated from the pale fascia at three-fourths by ground color; it differs in other details of markings and also in the color of the hind wings.

Gelechia trilineella Chambers

Three specimens reared from larvae webbing ends of shoots of sagebrush, *Artemisia tridentata.* Larva pale whitish grayish green (of the same color as the leaves of the sagebrush), with tubercle areas and six longitudinal stripes pale brownish, the two lateral stripes the broadest; head, first thoracic segment and legs black. The stripes tend to fade out in the older larvae. Larvae collected June 9 and June 11, on lower slopes near mouth of Logan Canyon; imagoes July 7 and July 11.

The species is evidently very common, as later on some sagebrush was observed with only shreds of leaves remaining, the shoots covered with silken threads and the entangled frass.

In one of these specimens the two longitudinal discal lines have joined, forming a single very heavy black streak, which includes both the discal spots; the plical streak runs from near base to beyond one-third. This specimen answers exactly the description of *G. bispiculata* Meyrick[1] which is therefore probably merely an extreme form of *trilineella.*

Gelechia frugalis new species

Head grayish fuscous, evenly dusted with blackish specks, face a little paler, silvery. Second segment of the palpi whitish within, densely dusted with blackish fuscous outwardly; brush nearly black; third segment silvery gray, spotted with black.

[1] Exotic Microlep., III, p. 23, 1923.

Fore wing uniformly dark brownish fuscous, with a faint bronzy and purple luster, microscopically irrorate. Almost immaculate; second discal spot at end of cell faintly indicated; a scarcely distinguishable paler transverse spot at apical third of costa. Hind wings gray, paler toward base; cilia gray with brownish bases. Legs densely dusted with dark fuscous, tips of tarsal segments paler. Abdomen lustrous dark fuscous, showing irridescent colors in some lights; first three segments above somewhat paler and yellowish. Expanse: 14.5–16 mm.

Type (♂), and one *paratype* (♂) reared from larvae folding leaves of service-berry, *Amelanchier alnifolia*, slopes of Logan Canyon, about 5000 feet altitude.

The leaf is folded edge to edge, with upper surface inside. The larva is pale greenish, with tubercle areas and six longitudinal stripes plum-colored, the middle stripe of each three the broadest; head and first thoracic segment, except the anterior margin, black. Larvae collected June 21 produced moths July 27.

This species appears to be undescribed and the knowledge of its life history will make certain its future identification.

Gelechia prognosticata new species

Palpi gray, finely dusted with black; brush mixed gray and black. Antennae blackish, basal segment whitish at tip. Scales of head pale gray, black-tipped. Scales covering the fore wing whitish at their bases shading through brownish or grayish fuscous to more or less distinct black tips. In one specimen, the brownish tints predominate above the cell, with grayish lines along the veins and along costa. Plical spot elongate; a few dirty yellowish scales beneath it toward base. First discal spot small, irregularly and partially edged with yellowish scales. Second discal spot sometimes minute, sometimes larger and obliquely placed and indistinctly continued toward tornus; a few yellowish scales on its inner side. A whitish irregular fascia, slightly angulated and sometimes broken and indistinct in the middle, crosses the wing at three-fourths. Cilia very pale gray, the scales overlapping them whitish with black tips. Hind wings and cilia fuscous. Legs white, densely dusted with blackish fuscous. Posterior margin of each segment of the abdomen above yellow; abdomen beneath white, with dusting, sparse along the median line, dense on the sides. Expanse: 18–20 mm.

Type (♂) and one *paratype* (♂) reared from larvae found on *Ribes longiflorum* near the mouth of Logan Canyon, June 9. The larva lives in a tube of frass in a curled leaf, which is usually

attached to the upper surface of another leaf. The larva is grayish; head and posterior half of thoracic shield black; six blackish stripes of which the middle one of each three is the broadest; tubercle areas grayish black. Imagoes July 7 (type) and July 11.

Brachmia casca new species

Nearly pure white. The labial palpi marked with a faint longitudinal pale ocherous line on the inner side and a broader pale ocherous line on the outer side of the second segment. Antennal stalk fuscous, with whitish annulations. Fore wings white; very faint pale ocherous streaks between the veins are dusted with fuscous at their ends along the costal margin near apex and along termen; a round blackish spot at end of cell; a short black streak on the middle of the fold. Hind wings and cilia white. Legs white, shaded with ocherous. Abdomen pale fuscous, anal tuft white. Expanse: 20 mm.

Type (♂), June 11, on a sagebrush slope in Logan Canyon near Cottonwood Canyon.

This species appears to resemble *Brachmia subalbusella* Chambers, which is, however, a smaller species, lacking the black discal and plical spots.

Trichotaphe stipendiaria new species

Labial palpi pale whitish ashen-hued, outer side of second segment except at tip fuscous; faint fuscous shading on the third segment. Antennae fuscous. Head and thorax fuscous, sides of head and tegulae pale, yellowish ashen in color. Costal area of the wing pale yellowish ashen, somewhat streaked and dusted with fuscous; dorsal area and apical fifth fuscous; the two shades blending along the middle of the wing, except where they are separated by the large blackish irregular patch which begins at the base of the fold and is enlarged and produced upwards in the middle of the wing. On its dorsal side this patch is not sharply defined. A diffuse fuscous spot at the end of the cell. The fuscous apical area is bordered on its inner side by a narrow black fascia which runs nearly parallel to termen almost to costa, thence curving outward nearly to apex of the wing. The fuscous apical area is still further defined by an extension of the pale costal area to the tornus just before the black fascia. A series of faint paler spots along the termen. Hind wings and cilia gray. Legs ashen, shaded with fuscous. Expanse: 17–18 mm.

Type (♂) and one *paratype* (♂) reared from larvae on *Solidago* species, on north slopes of Logan Canyon under Douglas fir, near Logan, about 5500 feet altitude. Larvae collected June 21 yielded moths July 10 (type) and July 8. The larvae feed chiefly on the leaves near the ends of the shoots, each larva making a cylindrical roll, with the upper surface of the leaf inside. The larva is pale whitish, with a greenish or grayish tint; head and first thoracic segment shining black; second thoracic velvety black; anterior half of third thoracic white, marked with five velvety black longitudinal dashes, the mid-dorsal one the shortest; posterior half of third segment concolorous with the rest of the body; the longitudinal dashes are continued as faint longitudinal stripes; tubercle areas dark.

This species is nearest to *T. setosella* Clemens; it differs from that species in the whitish inner side of the palpi, the less clearly defined markings, the straighter costal edge and less rounded apex.

Oecophoridae

Agonopteryx umbraticostella Walsingham

Three specimens reared on *Balsamorrhiza sagittata*, amongst sagebrush, near Logan. The larva folds together the tip of the leaf, mining irregularly into it toward the base on either or both sides of the midrib, As the larva increases in size, the mine becomes inflated. Pupa in a slight cocoon. Larvae collected June 21; imagoes July 14.

Depressaria heracliana DeGeer

Larvae common in flower heads of wild parsnip along roadsides and waste places.

Schiffermuelleria dimidiella Walsingham

One specimen observed, but not captured, Bear Lake, June 29.

Ethmiidae

Ethmia semilugens Zeller

One specimen, Dry Lake, June 17; sagebrush association.

Ethmia semitenebrella Dyar

One specimen, Logan Canyon, June 26; sagebrush association.

Ethmia discostrigella Chambers

One specimen, near Logan, June 9; sagebrush association.

Olethreutidae

In this family I have followed the recent work of Heinrich, in generic and subfamily groupings, as well as in nomenclature. For references to the species of the subfamily Eucosminae, see the "Revision of the North American Moths of the Subfamily Eucosminae of the Family Olethreutidae," by Carl Heinrich.[2] Probably all the species recorded from Utah in that paper, will be found in the territory covered in my paper, when the region is more thoroughly studied.

Bactra maiorina Heinrich

Heinrich, Proc. Ent. Soc. Wash., xxv, p. 105, 1923.

Two specimens, Bear River Bay, Great Salt Lake, June 14.

Bactra furfurana Haworth

Four specimens, Tony Grove Lake, 7600 feet, July 12, amongst *Eleocharis*.

Exartema punctanum Walsingham

Larva on *Cornus stolonifera*, Logan Canyon, June 26; imago July 7.

Olethreutes duplex Walsingham

St. Charles, Idaho, swamp, June 28.

Olethreutes fuscalbana Zeller

Tony Grove, July 12, 7000 feet; aspen grove.

Thiodia corculana Zeller

One specimen, at light, Cache Junction, July 3.

Thiodia elongana Walsingham

One specimen, June 24, Providence Lake (near Providence Peak), montane meadow, 8600 feet; one specimen, July 18, Spring Hollow, aspen grove, 7000 feet.

Thiodia misturana Heinrich

June 24, Providence Lake, montane meadow, 8600 feet.

[2] Bulletin 123, United States National Museum, 1923.

Thiodia parvana Walsingham

Ten specimens, some showing very distinctly the ocherous scaling mentioned in the description of the species, others an almost uniform dark gray. Mr. Heinrich, to whom I sent one of the series thus identified, writes as follows: "The genitalia, however, are different [from *misturana*], the harpes somewhat stouter at cucullus, and the aedoeagus considerably smaller. Your determination is probably correct, but that of course we can never be sure of until we can compare with the actual type of Walsingham's species." The species is quite similar in marking to *misturana*.

The moths were taken resting on *Chrysothamnus graveolens*, in the meadow at the margin of Yellowstone Lake, Yellowstone National Park, July 5. My reason for including this species in the list of northern Utah material is that Eucosmid larvae were found forming bud-galls in the ends of shoots of the same plant at Logan, but were not reared, owing to the peculiar resinous character of the leaves. These larvae are perhaps *Thiodia parvana*.

Thiodia pallidarcis Heinrich

One specimen, Franklin, Idaho, June 20, sagebrush association. This specimen is very pale, almost white, with faint ocherous markings only and lacks fuscous shades entirely; it however, agrees exactly in markings with California specimens.

Eucosma argentialbana Walsingham

The commonest tortricid of the sagebrush association; near Logan, June 10 to June 26; Bear Lake, June 28.

Eucosma pergandeana flavana Fernald

St. Charles, Idaho, June 28, alkali flats.

Eucosma agricolana Walsingham

July 8, near Logan, sagebrush association.

Eucosma subflavana Walsingham

Two specimens, July 11, near Logan, sagebrush association.

Eucosma maculatana Walsingham

One specimen, June 26, near Logan, sagebrush association.

Eucosma bobana Kearfott

One specimen amongst Douglas fir, June 26; there are no pines within several miles of the place where this specimen was taken.

Eucosma lolana Kearfott

One specimen, June 26, north slopes in Logan Canyon, in transition vegetation community.

Eucosma popana Kearfott

One specimen, June 26, Logan Canyon, sagebrush association. The specimen is in poor condition, but the genitalia agree exactly with Heinrich's figure.

Eucosma biplagata Walsingham

Two specimens, near Logan, lower west slopes of the mountains, July 11.

Eucosma expolitana Heinrich

Five specimens, June 26, July 8, July 16, near Logan, in the sagebrush association.

Epiblema minutana Kearfott

The specimens of this species taken amongst sagebrush at Logan agree with the form described by Kearfott as *minutana*, and not with the larger *strenuana* form.

Zeiraphera diniana Guenée

Spring Hollow, July 18, amongst Douglas fir.

Epinotia pulsatillana Dyar

Several specimens reared on *Clematis ligustricifolia*, Logan Canyon. Larvae collected June 9; imagoes July 7 to 16.

Epinotia rectiplicana Walsingham

Spring Hollow, July 18, in transition vegetation community.

Hystrichophora asphodelana Kearfott

June 29, 7500 feet, sagebrush association; July 12, montane meadow, 7800 feet, near Tony Grove Lake.

Hemimene radicicolana Walsingham

Tony Grove, July 12, 7000 feet.

Hemimene britana Busck

Busck, Proc. Biol. Soc. Wash., XIX, p. 178, 1906.

June 21 and June 26, transition community, Logan Canyon; June 20, Franklin, Idaho; July 12, montane meadow, near Tony Grove Lake, 7800 feet.

TORTRICIDAE

Sparganothis distincta Walsingham

A very common species of the transition vegetation community, where the larvae tie together the terminal leaves of shoots of *Solidago* species. Larvae collected June 21 on north slopes of Logan Canyon yielded moths from July 7 to July 19. I am indebted to Mr. Busck for the identification.

Sparganothis californiana Walsingham

Larvae on leaves of an unidentified composite, alkali flats, St. Charles, Idaho, June 28.

Platynota nigrocervina Walsingham

Larva, June 9, sewing together leaflets of *Hedysarum pabulare;* imago, July 7. Lower gravel slopes at mouth of Logan Canyon.

Cacoecia cerasivorana Fitch

Large colonies of the larvae enclose the twigs of choke cherry, *Prunus melanocarpa*, with their webs wherever the food plant occurs, from the lowest altitudes up through aspen groves and montane meadow. At the lower altitudes, larvae are nearly full grown the early part of June and these produced moths from July 7 to July 15.

Cacoecia argyrospila Walker

Of economic importance in the apple orchards.

Tortrix peritana Clemens

In waste places and along irrigation ditches, June 16, June 25.

Harmologa fumiferana Clemens

July 16, on Douglas fir.

Cnephasia argentana Clerck

St. Charles, Idaho, swamp, June 28; Tony Grove Lake, montane meadow, 7800 feet, July 12.

Peronea foliana Walsingham

A very common species of the mountain mahogany, *Cercocarpus parvifolius;* in some places on the lower slopes of Logan Canyon almost every little twig supports at least one larva. Reared and captured specimens are dated from July 3 to July 19.

Peronea nivisellana Walsingham

One specimen reared on *Physocarpus malvaceus;* the larva was found July 8, north slope of Logan Canyon, 5500 feet.

Phaloniidae

Phalonia angulatana Robinson

Logan, July 1.

Phalonia campicolana Walsingham

Montane meadow around Providence Lake, 8600 feet, June 24.

Phalonia species

One of the commonest species of the montane meadow near Tony Grove Lake, 7800 feet, July 12. Mr. Heinrich, to whom a specimen was sent, writes: "Considered by Walsingham and Fernald to equal *P. deutchiana* Zetterstedt of Europe, but probably distinct."

Hysterosia aureoalbida Walsingham

A common species of the montane meadow near Tony Grove Lake, July 12; also in Card Canyon, June 24, altitude 6000 feet.

Heliodinidae

Heliodines extraneella Walsingham

One specimen reared from a miner of leaves of *Gaura neomexicana,* Logan.

The green larva makes several mines; the last is a large whitish blotch, with the frass retained within the mine. Pupa on a stem, held in place merely by a few criss-cross strands of silk.

The nearly full-grown larva was found June 21; the moth emerged June 30.

In this specimen, the first pair of costal and dorsal silvery spots form a complete fascia; the last costal and dorsal spots are also metallic, and not snow-white, except when viewed sidewise.

Heliozelidae

Antispila aurirubra Braun

Braun, Can. Ent., xlvii, p. 195, 1915.

The mines of this species are very common on *Cornus stolonifera* along the banks of the Logan River. Larvae are full-grown in the latter part of June, and pupate at once, but the moths do not emerge until late fall or early spring.

Glyphipterygidae

Allononyma vicarialis Zeller

One specimen reared on *Betula fontinalis*, along the Logan River; imago, July 2.

Choreutis gemmalis Hulst

Five specimens were reared from larvae on balsam-root, *Balsamorrhiza sagittata* near Logan; two were captured amongst balsam-root, Franklin, Idaho, June 20.

The larva feeds beneath a web spun across either the upper or lower surface of a leaf, bending it slightly; either the upper or the lower epidermis is left uneaten, as the case may be. Occasionally two larvae inhabit one web. The elongate spindle-shaped cocoon of fine white silk is spun on the leaf beneath the web. The larvae were collected in Logan Canyon, near Cottonwood Canyon, June 11; the moths emerged June 24 and June 29.

This species differs from the other Balsamorrhiza-feeder, *C. balsamorrhizella* Busck, in its smaller size, brighter, more orange color, and straight outer edge of the basal area of the wing, golden, instead of blue or bronzy metallic longitudinal subcostal and median basal streaks, darker hind wings with little or no white on the upper surface.

Choreutis occidentella Dyar

Four specimens, head of Card Canyon, in aspen groves, 7000 feet, June 24; one specimen, Tony Grove Creek, 7000 feet, in aspen groves.

Choreutis multimarginata new species

Palpi white, a few black scales in the brush of the second segment, and on the third segment. Antennae white, with black annulations. Head, thorax and basal third of fore wings whitish fawn. Beyond the basal white area is an olivaceous

brown band, broadest on the costa. On this band are the following patches of metallic scales: on its inner edge below the fold, a patch of metallic scales bordered with black contiguous to the whitish basal area; a transverse patch of metallic scales, white on extreme costa, and inwardly black-bordered, divides the band nearly to the middle of the wing; on its outer edge just below costa, a rounder black-bordered metallic spot; on the middle of its outer edge, a smaller metallic patch; a little beyond its outer edge below fold, a few metallic scales. Beyond the olivaceous band, an irregular patch of white-margined black scales, not reaching costa, but extending along dorsum to tornus. Beyond this, an irregular whitish fawn patch occupies the wing above the fold to the apical fourth; its outer margin is sharply dentate, the spaces between the teeth filled with white-margined black scales; a patch of these scales near the lower edge of the whitish patch; a small metallic spot in the middle of the inner margin of the white patch. Below the end of the cell a large patch of metallic scales surrounded by black, separated from a second transverse metallic and black patch by a transverse oblique yellowish streak. Apex of wing olivaceous with a curved metallic line; a terminal row of white-margined black scales; cilia olivaceous. Hind wings dark fuscous. Underside of fore wings dark fuscous, with two white costal spots and white terminal line of scales; underside of hind wings fuscous, rather evenly overlaid with whitish scales. Legs white, with blackish dusted annulations. Underside of body white, with black dusting. Expanse: 12 mm.

The *type* (♀) was reared from a larva found webbing leaves of a mint, in a montane meadow near Tony Grove Lake, 7800 feet, July 12. The web is on the lower side of the leaf, drawing it together; on the same plants some leaves had been folded edge to edge with the upper surface inside, presumably in an earlier larval stage. The moth emerged July 27.

This species is close to *C. leucobasis* Fernald, which has been recorded from British Columbia, feeding on *Anaphalis*.[3] The very different food plant makes it highly improbable that the two are identical. The most striking peculiarity of *C. multimarginata* is the white-margined, not merely white-tipped black scales.

Glyphipteryx californiae Walsingham

Twenty specimens, marshy ground, Cache Valley, Logan, July 1. In none of these specimens is there a whitish basal streak;

[3] Busck, Proc. U. S. Nat. Mus., xxvii, p. 750, 1904.

the oblique whitish streak or blotch usually arising from near base of dorsal margin is replaced by a broad, almost quadrate spot, truncate on the fold.

Glyphipteryx montisella Chambers

Two specimens, head of Swan Creek, Rich County, Utah, altitude 6300 feet, June 29; transition community.

Plutellidae

Cerostoma elongata new species

Labial palpi outwardly blackish fuscous with slightly paler mottling; base and inner side of second segment pure white; a few white scales on upper side of third segment. Antennae white, with narrow black annulations. Head, thorax and fore wings light brown, with faint reddish coppery luster. The reddish luster is especially marked along the basal two-thirds of costa. Wings entirely immaculate, except for a small tuft of dark brown scales projecting from the apex of the wing into the cilia. Hind wings gray, unusually narrow and elongate. Underside of body, especially the thorax, whitish. Legs whitish, except anterior tarsi, which are dark fuscous except at apex of segments. Expanse: 16 mm.

Type (♀), July 7, from a cocoon found July 2, near Cottonwood Canyon, altitude 5500 feet. The cocoon was spun on juniper near the ground, the larva apparently having fed on a near-by plant.

Plutella porrectella Linnaeus

Two specimens, Tony Grove, July 12, in an aspen grove.

Plutella maculipennis Curtis

Common everywhere in the region but especially common amongst a wild crucifer along the edges of cultivated fields.

Yponomeutidae

Argyresthia monochromella Busck

Busck, Can. Ent., LIII, p. 280, 1921.

Eleven specimens, taken amongst Douglas fir, which is probably the food plant, on north slopes in Logan Canyon, altitude about 5500 feet, June 26. In all of these specimens there is faint reddish tinge along the costa.

Zelleria gracilariella Busck.

Busck, Proc. U. S. Nat. Mus., xxvii, p. 753, 1904.

Larvae collected in Spring Hollow, altitude about 6500 feet, on *Ribes cereum,* July 18. The larvae spin a fine web which envelops all of the leaves of a small twig, and then feed on the underside of the leaves, eating out holes. Imagoes August 10 to August 17.

Coleophoridae

Coleophora piperata new species

Palpi white, a gray streak on outer side near apex, and sometimes the short tuft on second segment gray; outer side of third segment sometimes gray. Basal segment of antenna whitish or pale gray, somewhat thickened with scales, the stalk white, distinctly annulate with gray. Face and head varying from whitish to pale gray. Thorax pale grayish, more or less densely dusted with scales varying in color from pale to dark gray. Fore wings with the ground color whitish, evenly dusted with gray scales, in some specimens so spaced as to produce a general pale gray color, in others so closely set as to obscure the whitish ground color; in these the wing appears dark gray and irrorated and in one or two specimens is almost a uniform dark gray. Cilia varying from almost pure white to a gray which is but little paler than the wing in the darker specimens. Hind wings in general concolorous with the fore wings, cilia more or less ocherous in the basal half. Legs whitish to gray, hind tarsi gray, white-tipped. Abdomen whitish beneath, gray above, with a double row of longitudinal dark gray dashes. Expanse: 14–16 mm.

Type (♂) reared from a larva on *Betula fontinalis.* The type specimen is intermediate in color between the extremes of light and dark forms. Nine *paratypes* (♂ and ♀) reared on *Betula fontinalis;* twenty *paratypes* (♂ and ♀) reared on *Salix* species. Paratypes have been placed in the collection of the Academy of Natural Sciences of Philadelphia and in the U. S. National Museum.

The larvae were collected June 21 on willow and birch growing along the Logan River. The earliest case is short, cylindrical, attached to the apex of the later case and is often lost before the larva is through feeding; final case sub-cylindrical, apex flattened, mouth slightly deflected, upper edge usually serrate, especially when the case is cut from the margin of a birch leaf.

The larva mines from the lower side of the leaf, the mines varying much in shape and extent. Imagoes July 7 to July 17; the date of emergence of the type is July 11.

This species is most closely allied to *C. pruniella* Clemens, *C. cinerella* Chambers, and *C. demisella* Braun; from the first two it is separated by the finely and evenly dusted fore wings; from the last by the conspicuously annulate antennae. The larval cases of all are similar.

Coleophora accordella Walsingham

Larval cases were collected on *Hedysarum pabulare*, June 9, on terrace slopes near the mouth of Logan Canyon; imagoes emerged from June 29 to July 15. The case is constructed in four sections, each case, except the first, being attached to the side of the new section. The first case is dark brown, subcylindrical and usually projects above the end of the finished case, each section of which except the first, is roughly triangular, with the mouth at one angle; the preceding section is attached to one of the more or less flattened lateral faces. The leaf epidermis of which the case is constructed is much wrinkled, as is also the epidermis of the mined leaf while the larva is feeding. At least when young the larvae usually mine from the upper surface of the leaf. While the larva is feeding, the case is somewhat inflated, with the pieces of leaf in loose folds, and measures about 10 or 11 mm. in length, and about 5 or 6 mm. in greatest width, along the upper side of the last triangular piece. At pupation the case is shortened and flattened and the separate sections come to lie in a line, and their sidewise attachment is not apparent.

Coleophora annulicola new species

Palpi white, a diagonal dark gray streak on the second segment running into the short tuft; a gray streak along lower side of third segment. Face and head gray with a few whitish scales on the side (male) or white, faintly tinged with pale ocherous (female). Basal segment of antenna somewhat thickened, gray, stalk white, annulate with pale brownish fuscous, each annulus including on the lower side, a black spot (male), or basal segment whitish, stalk white, each segment marked beneath with a black spot, very rarely faintly annulate (female). Thorax gray with a few white scales (male), white with a few pale ocherous scales (female).

Fore wings rather dark brownish fuscous (male) or pale grayish ocherous, sometimes whitish ocherous (female); marked with white lines following the veins and margins of the wings. In the female, these lines are broader and more distinct; the white line following the wing margin is broadest on the basal half of the dorsum, and broken just before the fold; a white line follows the upper margin of the cell, sending three branches to the costa; a fourth detached line runs into the costa just before apex; a fine line beginning on the middle of the cell forks into two heavier lines running to termen; a line along lower margin of cell runs to termen; a line just below fold to the margin. The lines are not always so clearly defined; sometimes they broaden and are partially confluent. In the male the white lines except the one along costa are always narrower and often broken; the white line along upper margin of cell is usually broken, leaving detached white streaks along the veins to costa; the wing below the fold is often entirely dark gray; the line along the lower margin of the cell is generally distinct, but occasionally also absent; sometimes the white line along the costa is the only distinct white line, and in one specimen even it is wanting and the entire wing is uniformly fuscous except for two or three short whitish dashes. Cilia varying according to the ground color of the wing, usually whitish on costa, shading to fuscous at tornus. Hind wings of the ground color of the fore wings. Legs gray (male), white (female). Abdomen gray (male), white (female), each segment above marked with paired longitudinal black dashes. Expanse: 13–17 mm.

Type (♂); *allotype* (♀), Logan, reared from larvae on *Aster* species. Nineteen *paratypes* (11 ♂, 8 ♀) reared from *Aster* species and *Solidago* species. Paratypes have been placed in the collection of the Academy of Natural Sciences of Philadelphia and in the U. S. National Museum.

Larval cases collected June 12 and June 21; imagoes, July 14 to August 23. The larval case is cylindrical, tapering but little toward the flatly compressed and longitudinally split apex, mouth but little bent. The case is about 18 or 19 mm. in length, 1.5 mm. in greatest diameter, and is made of a series of many (thirty or more) ring-like pieces of leaf epidermis. Just before leaving each mine to form a new mine, the larva cuts out a ring of epidermis around the entrance hole. The entrance hole of a deserted mine is thus in every instance greater in diameter than the mouth of the larval case. Each ring is attached around its inner circumference to the mouth of the case; its outer cir-

cumference is puckered sufficiently to increase but very little the diameter of the mouth of the case.

The males and females of this species are so different that captured specimens would undoubtedly be described as different species.

Larval cases of this species were collected in Glacier National Park, Montana, but no moths were reared.

Coleophora crinita Braun

Braun, Proc. Acad. Nat. Sci. Phila., p. 15, 1921.

Eight specimens, Dry Lake (5700 feet), June 17; one specimen, Providence Lake (8600 feet), June 24; five specimens, Logan Canyon, near Cottonwood Canyon, July 2; five specimens, Tony Grove Ranger Station, July 12; all amongst a mixed sagebrush and herbaceous vegetation.

Coleophora wyethiae Walsingham

One moth which emerged July 27 from a large silken case found on leaves of *Aster* species, along roadsides near Smithfield, June 16, answers the description of this species very closely. The case is elongate, 23 or 24 mm. long, nearly cylindrical, narrowing a little just before the slightly flaring mouth, and gradually tapering to the triangularly compressed apex; it is brownish, with longitudinal darker streaks.

Coleophora castipennella Walsingham

One specimen reared from a case found attached to the upper side of a willow leaf, along the Logan River, Logan, June 9. The markings and reticulation of the case resemble those of the case of *C. querciella* Clemens; the "handle" is larger. In this specimen, a male, the fore wings, instead of being pure white as described by Walsingham, are dusted with fuscous scales, especially in the costal and apical part of the wing.

Besides the above named species, five more species were taken, each represented by a single specimen. Several additional species were collected in the larval state, but were not successfully reared.

Elachistidae

Elachista salinaris new species

Palpi white, second segment fuscous on the outer side. Head white. Antennae pale fuscous. Thorax and ground color of

the fore wings white. Extreme costal edge near base black; a brownish shade along costa from base to two-thirds where it broadens to form a triangular costal patch, which is continued as an oblique jagged brown line across the wing to the termen. On the middle of the fold a large conspicuous elongate deep velvety brown spot. A few pale brownish scales below the fold; a cluster of pale brownish scales forms a diffuse spot at the tornus. In the apical part of the wing, beyond the oblique jagged line, are a few clusters of brownish scales, one lying on the costa before apex. Cilia white, faintly tinged with yellow; a line of brownish-tipped scales through their middle. Hind wings and cilia dark fuscous. Undersides of both pair of wings dark fuscous. Legs pale fuscous. Abdomen fuscous above, becoming paler and brownish toward tip, whitish beneath. Expanse: 11 mm.

Type (♂) and one *paratype* (♂) reared from mines on leaves of rush, *Scirpus paludosus*, collected at Bear River Bay, Great Salt Lake, June 14.

The mine is long, irregular, varying in width from one to three millimeters; in some places nearly transparent, elsewhere packed with frass; its early portion is scarcely visible, later the parenchyma is entirely consumed. Pupa very slender, elongate, thorax slightly rugose; median dorsal ridge low anteriorly but extending onto the thorax; lateral ridges prominent; attached to the surface of a leaf by a median silken girdle; no cocoon.

The imagoes emerged June 29.

Elachista orestella Busck

Busck, Can. Ent., XL, p. 196, 1908.

Three specimens, north slopes near the mouth of Logan Canyon, altitude 6000 feet, July 16, can not be distinguished from typical eastern specimens of this species.

Elachista sincera new species

Palpi and head white; antennae shaded with fuscous, especially in the outer half. Thorax and fore wings pure white. Hind wings silvery white, cilia white. Legs white, tarsi, especially of the fore and middle legs, shaded with fuscous. Abdomen white. Expanse: 9 mm.

Type (♀), June 26, north slopes about 5500 feet, in Logan Canyon amongst open growth of Douglas fir and juniper.

Venation of fore wing: R_4 absent, M_2 out of base of M_1: hind wing as in *E. orestella* Busck.

The entirely pure white of the fore wing and the different venation separates this from all other species.

Elachista herbigrada new species

Face pale golden, head above grayish white, palpi whitish, outer side of second segment, base and a faint row of dots on the underside of the third segment fuscous. Antennae gray with darker annulations. Thorax pale gray. Fore wings dark gray, slightly irrorate; a spot at the base of the inner margin whitish; a white fascia at one-third a little oblique and farther from base on dorsum; a second fascia at the apical third, inwardly oblique, broadest on the margins and constricted in the middle; cilia at extreme apex white, elsewhere dark gray; scales at extreme tip of wing, projecting over the white cilia, white with minute black tips. Hind wings and cilia gray. Legs gray; hind tibiae white, with base and a broad band just before the apex black; hind tarsi blackish, tips white. Expanse: 9.5 mm.

Type, (♀), June 24, Providence Lake, below Providence Peak, altitude 8600 feet, in a mountain meadow.

Venation as figured in Meyrick's Handbook of British Lepidoptera, p. 664.

The two fasciae and white apex characterize this species.

Gracilariidae

Lithocolletis pernivalis new species

Head and tuft white, antennae white, except the last two segments, which are black. Thorax and fore wings pure shining white; in the apical half of the fore wing pale golden shades border inwardly the fine dark brown lines which mark the position of white costal and dorsal streaks; this pale golden color also extends around the apex of the wing to the tornus within the marginal line of dark brown-tipped scales at the base of the cilia. At the middle of the costa a somewhat oblique dark line extends to the middle of the wing; this is followed by three nearly perpendicular dark lines, sometimes represented only by a few scales each; these four dark lines are nearly equally spaced. dark lines, sometimes represented only by a few scales each; these four dark lines are nearly equally spaced. The inner golden border of the third dark line continues across the wing to the tornus, sometimes the dark line itself continues across the wing and meets the dark brown marginal line at the tornus. Before the tornus on the dorsum, is an oblique brown line, its apex just beyond the apex of the second costal dark line. Hind wings and cilia almost pure white. Legs and underside of the body white. Upper side of abdomen pure white in the female, fuscous in the male. Expanse: 7–7.5 mm.

Type (♂) and four *paratypes* (1♂, 3 ♀) reared from tentiform mines found on maple, *Acer grandidentatum*, on north slopes in Logan Canyon, altitude about 5500 feet, July 16.

The mine is whitish, with parenchyma finally almost entirely consumed, and the loosened epidermis drawn into one heavy and several fine wrinkles. The mine is usually placed in the middle of the leaf, sometimes at the tip of one of the lobes, which is then bent under. The pupa is held merely by a few threads.

Date of emergence of the type, July 19; of the paratypes, July 17 and July 19.

This extremely beautiful species, the purest white one of our fauna, is nearest to *L. clemensella;* the purer white color, the less oblique first costal streak, and absence of apical spot easily distinguish it.

Lithocolletis affinis Frey and Boll

Two specimens of this species were taken resting on *Symphoricarpos*, July 18, in aspen groves at 7000 feet in Spring Hollow; a small tentiform mine found at the same time on *Symphoricarpos* yielded a moth July 21.

This species is easily distinguished from *L. tritaenianella* Chambers, its nearest ally, by the presence of a white dorsal streak beyond the third fascia.

Lithocolletis superimposita new species

Palpi white, fuscous on the outer side, face white, tuft white, with ocherous hairs intermingled, but usually with the white predominating; thorax golden ocherous, white anteriorly, a white line passing across the tegulae onto base of fore wings. Fore wings golden ocherous; a curved white basal streak from inner margin to a little above the fold, outwardly margined with black scales; two white fasciae, acutely angled near the costa, one at basal third, the second at the middle; their dorsal arms a little curved and strongly dark margined behind; their costal arms usually dusted inwardly on costa, rarely behind, and sometimes without dark margins. These fasciae are sometimes interrupted just above the angle. The second fascia and its dark margin are produced along the middle of the wing. A curved white dorsal streak just before tornus, dark margined behind, is a little less oblique than the dorsal arms of the fasciae; opposite it on the costa, a small white, dusted spot, its position often in-

dicated only by the dark dusting. A white costal streak at three-fourths with a few dark scales on costa before it, curves to the middle of the wing where it meets the angle formed by the junction of the white costal streak before apex and the white streak below apex, which enclose the dusted apex of the wing. Cilia ocherous; a small tuft of scales in the cilia opposite apex; two black lines in cilia along termen before the white streak. Hind wings and cilia pale gray, with a faint ocher tinge. Legs white, shaded with fuscous; hind legs pure white, except for the fuscous inner sides of the tibial spurs, a blackish shade on the outer side of the tibiae and minute black spots on the tarsi. Abdomen white; mid-dorsal line fuscous; median and two lateral ventral lines fuscous. Expanse: 8–8.5 mm.

Type (♂) and six *paratypes* (♂ and ♀), reared from blotch mines on the upper side of leaves of maple, *Acer grandidentatum*, at altitudes of about 5500 feet on north slopes near the mouth of Logan Canyon. One of the paratypes has been placed in the Academy of Natural Sciences of Philadelphia.

The mine is a rather small whitish blotch on the upper side of the leaf, with one or two wrinkles in the epidermis at the time of pupation. Occasionally a single mine contains two larvae. The mines were found July 8 and July 16; the moths emerged July 19, July 21, and July 27.

No mines were observed at the lower altitudes in the hotter and drier, and more exposed situations.

This species is nearest to *L. macrocarpella* Frey and Boll, but differs from it by the more golden color of the wings, more oblique dorsal arms of the fasciae, and the union of the apices of the three white streaks in the middle of the wing before the apex.

Parectopa albicostella new species

Labial palpi white inwardly, second segment outwardly divided diagonally into a blackish basal half and a white apical half; third segment white, with a black annulus before the tip. Maxillary palpi black, tip whitish. Antennae dark gray, anterior edge white for one-third the length. Face and head dark brownish gray, with a sprinkling of white hairs and scales. Thorax brownish black, streaked with white scales. Fore wings brownish black, somewhat dusted with white in the apical half. Costal edge from basal sixth to apical sixth white; five white costal streaks, and a white dorsal stripe, dusted with dark brown, along the margin from base to tornus. The first costal streak leaves the costa at the beginning of the white costal edge, lying close

alongside of it nearly to the middle of the wing, where it bends and passes obliquely to the middle of the wing, and is prolonged as a fine line to the apical third; second costal streak from middle of costa, broader and curved, not reaching the middle of the wing; third costal streak longer than the second and less oblique; the fourth costal streak, at the end of the white costal edge, is broad and white on the costa, silvery beneath the costa, and continues across the wing to the termen as a silvery fascia; fifth streak inwardly oblique; sometimes connected with a white half-crescent which borders the black apical spot. From the dusted dorsal stripe a blunt projection reaches the fold at the basal third, an oblique pointed projection projects above the fold before the middle; a larger white projection just before the tornus sends a fine white line nearly to the silvery fascia. Beyond the end of the dorsal stripe, and separated from it by a black streak in the fold, is a dusted white patch. Cilia around the apex white with deep brown tips; a conspicuous brown ciliary hook. Hind wings gray. Legs black, striped with white; hind femora silvery white with narrow black stripes; tibiae with diagonal white bars; tarsi white-tipped. Lower surface of body white. Expanse: 11.5 mm.

Type (♂) reared from a miner on vetch, collected in Spring Hollow, at 6800 feet altitude, in an aspen grove, July 18. The white upper side mine at first runs along the midrib, later irregular projections cover the greater part of the leaf surface. The small smooth brown cocoon is spun in a fold of the leaf. Imago, August 5.

Closely allied to *P. salicifoliella* Chambers, *P. thermopsella* Chambers, and *P. occulta* Braun, but separated from all of them by the dark head and thorax and the white costal edge.

Ornix alta new species

Labial palpi whitish, a conspicuous black spot on the under and outer side of the third segment; antennae gray, with faint paler annulations; tuft on the head mixed light and dark gray scales. Thorax with the middle portion pale gray, tegulae darker. Fore wings nearly black, slightly irrorated, and marked with silvery white costal and dorsal streaks. Two very oblique obsolescent streaks before the middle of costa; a shorter, broader and not very oblique, silvery streak on middle of costa; at two-thirds a nearly perpendicular silvery streak continues as a narrow fascia across the wing to the tornus; it is broken and somewhat indistinct near the tornus; between the fascia and a pair of costal streaks placed close together just before the apex is a short inwardly oblique costal streak. A few scattered white

scales below the fold in the basal fourth. At basal third of dorsum a conspicuous, slightly oblique silvery spot reaches above the fold. Before the tornus an oblique white streak nearly meets the fascia in the middle of the wing. Scales around the apex black-tipped. Near the outer edge of the cilia two dark lines, very close together, are confluent opposite the apex. Hind wings and cilia gray. Legs blackish, tarsi silvery gray, with black tips. Expanse: 7–8.5 mm.

Type (♂) and three *paratypes* (2 ♂, 1 ♀) reared from mines on leaves of service-berry, *Amelanchier alnifolia*, collected at Dry Lake, altitude 5700 feet, June 17. The mine is a tentiform, underside mine, with loosened epidermis much wrinkled, pale brownish and speckled. The larva pupates immediately after leaving the mine. Similar mines occasionally are seen on the upper side of the leaf. Date of emergence of the type, July 2; paratypes, July 1 and July 2.

Gracilaria melanocarpae new species

Head dark purplish brown with indistinct paler dusting. Labial palpi dark purplish brown, second segment pale above, third segment thickened toward apex which is yellowish gray. Maxillary palpi dark purple beneath and whitish above. Antennae dark purple, second segment whitish, rest of the stalk with pale gray annulations. Thorax and fore wings dark purplish brown, with whitish markings. A narrow, somewhat broken, whitish fascia crosses from costa near base obliquely to the basal fourth of the dorsum, where it usually broadens and is marked on the margin by a small brown dot. Near middle of costa is a V-shaped mark, its arms resting on costa and including between them a patch of the ground color, its apex just below the fold; opposite its apex on the dorsum is usually a small whitish spot. The arms sometimes do not reach the costa, which is then marked in that position by a row of white dots. Two whitish costal patches beyond the V-mark, the first of which is often marked on the costa by one or two dark spots. Beyond these are two faintly paler irregular patches on the costa. On the middle of the dorsum an irregular whitish patch; in the fold, a little farther out, a small whitish spot, and beyond it a second whitish spot. Except on the dorsum, where they are gray, the cilia are of the ground color and marked with several parallel darker lines of scales. Hind wings gray, cilia gray, with bases brownish. Legs dark purplish brown, except the tibiae of the hind pair and all the tarsi which are yellowish brown, with dark purplish tips. Abdomen dark gray above, yellowish brown near base, and with a yellowish anal tuft in the male. Expanse: 15.5–16.5 mm.

Type (♂) and two *paratypes* (♂ and ♀) reared from larvae taken on choke cherry, *Prunus melanocarpa*, Providence Canyon, June 24, at an altitude of about 7000 feet.

The mine is at first a narrow "snail" track, which becomes an elongate blotch on the underside along the leaf margin. Within this blotch, the parenchyma is entirely consumed and the lower epidermis so much wrinkled that the leaf appears as if folded under at the edge. Upon leaving the mine the larva rolls the entire leaf into a cone; within the cone the leaf is cut entirely across, and the cut margin is sewed down to form the cone; the detached apical part of the leaf is eaten, except for a few fragments. The cocoon is double, spun outside of the cone.

The type emerged July 19; the paratypes, July 17 and July 19.

Cones of this species were also collected above Tony Grove Lake at an altitude of about 8000 feet, but no moths were reared. Larvae were not observed at the lower altitudes, although the food plant is common.

This species is very close to *Gracilaria serotinella* Ely, also a *Prunus* feeder, but the additional two white spots in the fold, and the absence of pale streaks in the cilia distinguish it from that species.

Gracilaria alnivorella Chambers

The larvae of this species were extremely plentiful on leaves of *Alnus tenuifolia* along the Logan River at Cottonwood Canyon, altitude 5500 feet, on July 2. No imagoes were reared as all the larvae collected proved to be parasitized.

My observations on the larval habits indicate that the larva, after leaving the small underside mine, folds under the leaf at the edge, then later makes the conical roll.

Gracilaria acerifoliella Chambers

Larvae collected on maple, *Acer grandidentatum*, in Dry Canyon, June 12, yielded moths from June 20 to June 26; two specimens were captured on the wing July 16 at an altitude of about 5500 feet, north slope of Logan Canyon. There is considerable variation in ground color and amount of brownish dusting.

The short linear mine ends in a small blotch with either the upper or lower epidermis loosened; the mining period is followed

by the making of a small cone out of the tip of one of the leaf lobes; the second cone is much larger and the cocoon is spun within it.

Gracilaria cornusella Ely

Ely, Ins. Insc. Mens., III, p. 53, 1915.

Cylindrical rolls, probably belonging to this species, were very common on *Cornus stolonifera* along the Logan River. At the time of observation, June 26, all the moths had emerged.

Scythridae

Scythris ochristriata Walsingham

One female, June 11, on a sagebrush slope near Cottonwood Canyon.

Lyonetiidae

Coptodisca ribesella new species

Head pale golden, antennae dark gray. Thorax and basal half of the fore wings silvery gray, with less golden tinge than the head. Outer half of the fore wings bright orange yellow. First pair of streaks brilliantly silvery, their apices obtuse and nearly meeting; black margins of the costal nearly parallel, scarcely converging toward the middle of the wing. A silvery costal spot and a silvery dorsal spot just before the blackish apical patch, the former black margined inwardly; the black apical spot preceded by a patch of silvery scales. Costal cilia between the two costal spots silvery; a black line extends out into the apical cilia. Wing behind the first dorsal silvery spot blackish to the tornus, this blackish shade separated from the blackish apex by the golden ground color and the silvery spot. Hind wings dark gray. Expanse: 4.5–5 mm.

Type (♀) and one *paratype* reared from miners in leaves of currant, *Ribes cereum;* the date of emergence of the type is August 1, that of the paratype July 24.

A narrow linear mine enlarges into a transparent pale green blotch, from which the unusually large pupal case is cut. The completed pupal case is reddish brown. Mines and pupae were collected July 8 near the mouth of Logan Canyon, and July 18 in Spring Hollow, altitude about 6000 feet.

This species is most like *C. arbutiella* Busck.

Coptodisca cercocarpella new species

Head silvery gray with faint golden tinge; antennae dark gray. Thorax and basal half of fore wings silvery gray, faintly golden; apical half orange yellow with a shade of brown. The pair of silvery costal and dorsal spots are nearly equal, black margined on both sides; from the outer dark margin of the dorsal a dark shade extends to dorsum and termen. The costal cilia beyond the first costal silvery spot are white, almost silvery, so that the position of the silvery costal spot just before the apical dark patch is defined only by its inner dark margin. These three costal dark margins are equally spaced and nearly parallel. Apical dark patch preceded by bluish metallic scales, and bordered beneath by a patch of silvery scales. The white costal cilia extend around the apex to the black pencil, which is unusually heavy; cilia beneath this pencil gray. Legs gray, faintly golden. Expanse: 5 mm.

Type reared from mountain mahogany, *Cercocarpus ledifolius*. On June 10, when the single pupa was found, most of the moths had emerged. Date of emergence of the type June 12.

The mine is an inconspicuous brownish blotch on the upper side of the leaf; the larva cuts an oval piece from the upper epidermis only, which it folds along the long axis to form the pupal case, which is thus straight on one side, convex on the other. The case is attached at one end to the leaf, projecting from it almost at right angles. Mines were observed in only one locality, on the rocky exposed west-facing cliffs of the mountains near Logan at an altitude of about 5300 hundred feet.

The species is apparently single-brooded, as no new mines were found on a second visit to the locality about a month later.

Leucoptera pachystimella Busck

Busck, Proc. U. S. Nat. Mus., xxvii, p. 774, 1904.

Mines of this species were collected on *Pachystima myrsinites*, June 26 and July 8, at altitudes between 5500 and 6000 feet, on north slopes in Logan Canyon. The mine starts as a linear mine later becoming a pale blotch which covers the whole upper surface of the leaf. Cocoon of the usual *Leucoptera* type. Imagoes emerged July 7, July 9, and July 27.

Phyllocnistis populiella Chambers

Mines of this widely distributed species were observed at an altitude of about 7000 feet in Providence Canyon on June 24.

Tischeria heliopsisella Chambers

Mines probably of this species were found on *Aster* along roadsides and irrigation ditches, July 8; the larvae pupated in the flat silken nidus characteristic of the species, but moths failed to emerge.

Bucculatrix chrysothamni new species

Head and tuft white; eye-caps white, antennal stalk pale gray, with broad black annulations. Thorax white. Fore wings pure white, marked with ocherous patches dusted with brown-tipped scales. An ocherous dusted patch on costa beyond the middle, sometimes extends as an ocherous shade across the wing, joining, on the dorsum nearer the base, a similar dusted patch, thus forming an inwardly oblique transverse band. A small patch of brown-tipped raised scales borders the inner edge of the dorsal patch just below the fold. Sometimes the ocherous connecting shade is lacking; the dorsal patch then ends at the fold. Occasionally, the dorsal patch is wanting; rarely the costal patch is absent, but in no case are both absent in the same specimen. Apical part of wing ocherous, dusted with brown-tipped scales; a group of these scales forms a dark spot at extreme tip of the wing, and continues as a faint line through the terminal cilia. A second line of dark scales, heaviest just above and opposite the apex, parallels this through the middle of the cilia. Cilia white, becoming ocherous at the tornus. Hind wings pale gray, faintly tinged with ocherous, cilia ocherous. Legs white, tarsal segments all tipped with dark brown. Abdomen grayish ocherous. Expanse: 10 mm.

Type (♂), near Logan, amongst rabbit brush, *Chrysothamnus graveolens*, June 25. The type specimen has the costal and dorsal patches connected.

Twenty *paratypes* (♂ and ♀), all collected at the same time as the type. Two paratypes have been placed in the collection of the Academy of Natural Sciences of Philadelphia.

The moths were collected by sweeping the rabbit brush, which is no doubt the food plant. They have the habit of resting at the extreme tip of the linear leaves, with head projecting beyond the apex of the leaf.

Bucculatrix tenebricosa new species

Head and tuft white; eye-caps white, antennal stalk white with broad dark gray annulations. Thorax white. Fore wings white with scattered pale brownish-tipped scales and clusters of dark brown-tipped scales. There is a cluster of a few of these dark-tipped scales on the middle of the costa; a large cluster at two-thirds of costa and a small patch of raised dark scales just beneath the fold. The dark-tipped scales extend along the base of the costal cilia and around the apex to the tornus, forming at the apex a scattered patch; an irregular line of dark scales runs through the cilia below the apex. Hind wings silvery gray with white cilia. Legs white, tibiae and tarsi of the fore and middle legs broadly banded with gray; hind tarsi only banded with gray. Expanse: 7 mm.

Type (♂), near Logan, amongst rabbit brush, *Chrysothamnus graveolens*, June 25. Two *paratypes* (♂ and ♀) taken at the same time.

Bucculatrix angustisquamella new species.

Head white, tuft of white and gray hairs intermixed; eye-caps dusted with gray, antennal stalk white with gray annulations. Thorax white, lightly dusted with gray. Scales covering the fore wings narrow. Fore wings white dusted with dark brown or black-tipped scales. These scales are grouped into ill-defined markings as follows: an elongate, scarcely defined patch in the fold near base; a rather narrow oblique streak from before middle of costa which usually joins a larger and darker patch on middle of dorsum, bearing a group of raised black scales towards its inner edge below fold; a broader less oblique streak from just beyond middle of costa, which touches, on its inner side, the above-mentioned dorsal patch, and on its outer side, in the middle of the wing, runs into the middle of a transverse band of dark-tipped scales. On the outer side of the transverse band below apex is a group of blackish slightly raised scales. Scattered dark scales at the base of the apical cilia, and a line of dark scales through the middle of the cilia. Hind wings grayish white, cilia pale gray with ocherous bases. Legs grayish white, tarsi tipped with gray. Expanse: 8 mm.

Type (♀), three *paratypes* (1 ♂, 2 ♀), amongst sagebrush, in Logan Canyon, near the mouth of Cottonwood Canyon, altitude 5500 feet, July 2.

In general, similar to the preceding species in character of markings, but much more densely dusted, and with certainty separated from it by the narrow scales of the fore wing.

Bucculatrix salutatoria new species

Head white, tuft with gray and dull ocherous hairs mingled with the white; antennae annulate with gray. Fore wings white, finely dusted with pale dull ocherous scales which are usually minutely darker tipped. Scales, more deeply dark-tipped, are grouped to form indistinct markings. These are: a narrow triangular oblique streak from before middle of costa; a second broader oblique streak ending in a black dot (sometimes nearly wanting) in the middle of the wing. A patch of scales, with more of the dull ocherous color, occupies the apical part of the wing; toward costa this patch divides into two or three more or less distinct transverse streaks, separated by the white ground color. Sometimes the general wing dusting is heavier and these markings scarcely contrast with it. A small patch of raised blackish scales on the middle of the wing below the fold, and a similar patch on the termen. A patch of black scales in the extreme apex; a line of black scales through the middle of the cilia. Hind wings shining, whitish, cilia grayish, with a coppery tinge. Legs grayish white, tarsi black-tipped. Expanse: 10 mm.

Type (♂), two *paratypes* (♂ and ♀), head of Swan Creek, Rich County, Utah, in the transition vegetation community, altitude 6300 feet, June 29.

Bucculatrix divisa new species

Head grayish white; brown hairs mingled with the whitish hairs in the tuft; eye-caps whitish, dusted with brown, antennal stalk gray with brown annulations, which become more distinct toward the tip. Thorax whitish, with brownish ocherous dusting. Fore wings pale brownish ocherous in the basal half shading to a more golden brownish ocherous in the outer half. In the basal half of the wing there is more or less white, sometimes so much that the basal half sharply contrasts with the outer half. Extreme base of wing usually whitish, except on the margins; a streak of white extends outwardly for a short distance beneath the costa. On the middle of the dorsum, a dark brown broad half-crescent is edged before and behind by a white curved streak. Dorsal margin dark brown from base to the white streak. A dark brown streak along the costal margin broadens out into a triangle at the basal third, where it forms the inner margin of a short white costal streak. Beyond the white streak, the margin is dusted with dark brown scales, which at two-thirds form the inner margin of a second white costal streak

which extends obliquely across the wing to the termen. This oblique streak is usually partly divided in the middle of the wing by a short longitudinal dark brown dash. Margins of the wing around the apex white, dusted with dark brown; a dark brown spot at apex. Cilia white, gray toward tornus, with a dark brown line through their middle. Hind wings and cilia rather dark gray. Legs gray, tarsi black-tipped. Expanse: 9 mm.

Type (♂) and two *paratypes* (♂), reared from larvae on balsam-root, *Balsamorrhiza sagittata*. Larvae and cocoons were collected June 16 and June 21 on plants growing amongst the sagebrush, at altitudes varying from 4500 to 5000 feet, near the mouth of Logan Canyon. The early mine is a very indistinct thread-like mine, which is later transparent, and finally enlarges into a small irregular transparent blotch. After leaving the first mine, the larvae feed on the lower side of the leaf, mining into the leaf, with head and thorax only inside the mine. These mines, of which each larva makes several, are usually squarish and never exceed two millimeters across. They are only distinguished from small *Coleophora* mines by the position of the circular entrance hole of the larva at one side of the mine. The cocoons, which are spun usually next to the midrib, are pinkish in color, sometimes brownish yellow, and marked with thirteen or fourteen very fine ridges. The type emerged June 29, the paratypes, June 26.

Bucculatrix crescentella Braun

Braun, Can. Ent., XLVIII, p. 140, 1916.

The mines of this species are common on asters along roadsides and irrigation ditches. From larvae collected June 16, five imagoes were reared, which in no way differ from typical eastern specimens.

Bucculatrix pomifoliella Clemens

Larvae were collected on *Physocarpus malvaceus*, in Logan Canyon, on north slopes at about 5500 feet altitude, July 8 and July 16, and in Spring Hollow, July 18. The moths emerged in March and April of the next spring.

The species was found on *Physocarpus* only of the native plants, in spite of the fact that other plants, more nearly related to its eastern food plants, were present in abundance.

Bucculatrix arnicella new species

Face pale silvery gray, tuft dark gray and white, the white hairs sometimes predominating. Eye-caps and antennal stalk gray, the latter with darker annulations. Thorax and fore wings so densely dusted with dark gray that the ground color appears to be an irrorated dark gray. A whitish dorsal streak just before middle, and a second beyond the middle; the ground color between them is usually darker than the rest of the wing. A whitish oblique costal streak at the middle of the costa is often indistinctly continued across the wing almost to the second dorsal streak. A second oblique costal streak extends across the wing toward termen, which it sometimes reaches, and is but narrowly separated from the second dorsal streak in the middle of the wing. A rather distinct line of black-tipped scales around apex and just below it in the cilia. Hind wings and cilia gray. Legs gray, with black-tipped tarsi. Abdomen silvery gray. Expanse: 8–8.5 mm.

Type (♀), one *paratype* (♂), reared from larvae feeding on *Arnica cordifolia;* two *paratypes* (♂ and ♀) from cocoons found on leaves of sagebrush, *Artemisia tridentata.* The specimens on *Arnica* emerged July 3; those on sagebrush June 29 and July 1 respectively.

The larvae on *Arnica* were mining on the underside of the basal leaves, making Coleophora-like mines similar to those on *Balsamorrhiza,* but much larger in area. Cocoons whitish or pale yellowish marked with nine or ten ribs.

The *Arnica* specimens were found on plants on a north slope, beneath Douglas fir, altitude about 5500 feet, Logan Canyon; those on sagebrush, Blacksmith Fork Canyon, altitude 5000 feet.

Incurvariidae

Lampronia sublustris Braun

Braun, Can. Ent., LVII, p. 127, 1925.

One female, north slope beneath Douglas fir, altitude 6800 feet, near Cottonwood Canyon, June 11. This specimen is the paratype cited in the description of the species.

Chalceopla discalis new species

Second segment of labial palpi white, third segment black. Antennae bronzy black, with the last three or four segments whitish. Hairs of the face and head orange yellow, except between the antennae, where they are black. Under-scales of the fore wing deep blue, entirely overlaid with brownish golden

elongate metallic scales; a faint reddish tinge on outer half of costal margin. An indistinct whitish spot lies across the end of the cell. Hind wings gray with a reddish and purplish luster except toward the basal half of costa; elongate brownish golden scales project from the wing margin over the bases of the gray cilia. Legs gray, with bluish and bronzy luster. Expanse: 8 mm.

Type (♀), north slope in Logan Canyon near Logan, June 26, beneath Douglas fir, altitude about 5500 feet.

This species is duller, with less of the deep golden and bronzy tints of the other species; in markings of wings and antennae it resembles *C. cockerelli* Busck, but in wing shape it is more closely allied to *C. itoniella* Busck.

Nepticulidae

MICROCALYPTRIS new genus

Head and face tufted. Labial palpi short, drooping. Maxillary palpi long, folded. Antennae exceeding half the wing length; basal segment somewhat enlarged and concave beneath to form a small eye-cap; second segment swollen. Posterior tibiae long, bristly above, middle spurs placed at two-thirds the length of the tibiae.

Fore wings narrow, lanceolate; media and radius coalescing to beyond the middle into a single vein running parallel with the fold and below the middle of the wing; R_1 given off almost at base, R_{2+3} from middle; R_4 and R_5 coincident. Media unbranched. Cubitus is either obsolescent or has coalesced with R + M. Hind wings narrow lanceolate, one-half the width of the fore wings; clothed only with scattered hair-scales; subcosta and R_1 coincident; R_s and M coalescing to beyond the middle of the wing; media unbranched (?) as in *Nepticula* or two-branched (?) as in *Trifurcula*.

Genotype, *Microcalyptris scirpi* new species.

The venation of the fore wing agrees with that of *Scoliaula* in the basal half of the wing, but differs from that of *Scoliaula* in that R_4 and R_5 are coincident and media unbranched. The narrow wings are also characteristic. It is not possible to determine with certainty the venation of the hind wing without injury to the single type specimen.

The eye-cap is small and inconspicuous in comparison with the large eye-caps of the other genera of the family (except *Acalyptris* Meyrick).

The only known species is a miner of leaves of rush (*Scirpus*).

Microcalyptris scirpi new species

Head and eye-caps rather dark brownish ocherous, antennal stalk brownish fuscous. Fore wings brownish ocherous, more yellowish than the head, a purplish fuscous shade at base of costa and an inwardly oblique purplish fuscous fascia just before apex. Cilia opposite the ends of the fascia and on dorsum purplish fuscous; cilia around apex ocherous, their tips paler than the ground color. Hind wings and cilia purplish fuscous, partially transparent because of the scattered clothing of hair scales. Femora of fore legs brownish ocherous, remaining segments purplish fuscous; basal segments of middle and hind pair and extreme base of hind tibiae purplish fuscous, tibiae and tarsi brownish ocherous. Expanse: 5 mm.

Type (♂), reared from a miner in a leaf of rush, *Scirpus paludosus*, at Bear River Bay, Great Salt Lake, June 14. The mine is an extremely narrow, scarcely widening, blackish track on the underside of the leaf, with loosened epidermis slightly elevated, about eight centimeters in length; at about one-half its length bending back and running parallel to itself. The mine is not visible from the upper side of the leaf. Cocoon brownish ocherous, ovoid, very convex above and lacking the usual projecting rim. Imago, June 29.

Nepticula marmaropa new species

Head ocherous; eye-caps and basal third of antennal stalk silvery; outwardly the stalk shades to dark fuscous. Thorax dark metallic. Basal third of the fore wing either silvery gray or dark lustrous metallic, showing golden and coppery reflections; beyond this metallic part, the wing is black to the silvery fascia, which is placed a little beyond the middle; from the middle of the outer side of the fascia, more or less scattered silvery scales extend half way to apex. Beyond the fascia the wing is blackish, irrorated, with the last row of scales around the apex pale brownish at their bases. Cilia white around the apex, shading to gray at the tornus. Hind wings dark gray. Legs dark shining gray. Expanse: 4.5 mm.

Type (♂) and two *paratypes* (♀) reared from larvae mining leaves of rose, *Rosa woodsii*. Mines containing full-grown larvae were collected on a north slope in Logan Canyon, July 16, altitude about 5500 feet, and in Spring Hollow, July 18, altitude 6000 feet. The imagoes emerged April 3, April 17, and April 23 (type) of the following year.

The linear mine suddenly expands into a small whitish green, transparent blotch. Cocoon very small, smooth, at first bluish green, later turning dark reddish brown.

This species bears a very close superficial resemblance to *Glaucolepis saccharella* Braun.

Nepticula taeniola new species

Head ocherous, eye-caps pale golden. Thorax and basal half of the fore wing golden brown, shading in the middle of the wing to a reddish brown, faintly coppery color; this color forms an ill-defined band preceding a silvery fascia at two-thirds; apical part of the wing concolorous with the reddish band in one specimen, suffused with deep blue-purple in the other; cilia around the apex lustrous pale gray; those on dorsum brownish. Hind wings and cilia gray. Abdomen and legs shiny gray. Expanse: 5 mm.

Type (♂) and one *paratype* (♀) reared from mines on leaves of service-berry, *Amelanchier alnifolia*, collected in Logan Canyon at an altitude of about 5000 feet, June 21 and June 26.

The mine begins as a short contorted linear mine, enlarging into a funnel, which soon becomes a large pale blotch; the linear and funnel-shaped parts of the mine, and the center of the blotch are densely packed with frass and blackish. The blotch portion of the mine is five or six millimeters in diameter. Cocoon pale brownish. Imagoes, July 9.

This species is nearest to *N. purpuratella* Braun.

Identical mines, untenanted, were observed on leaves of *Crataegus* species, Franklin, Idaho, June 20.

STUDIES IN THE DIPTEROUS FAMILY EPHYDRIDAE, EXCLUDING THE NORTH AND SOUTH AMERICAN FAUNAS

BY EZRA T. CRESSON, JR.

In this series of papers I am presenting the result of my studies in this group of the Diptera, based on material from various parts of the world excepting North and South America, comprising notes on some of the known, and descriptions of several new, genera and species.

Through the kindness of Dr. Carl Zerny of Vienna, I have had the privilege of studying the Ephydridae belonging to the Naturhistorischen Museums in Vienna (reference to such material is made thus [Vienna, 5], the number indicating the number of specimens examined). The study of this collection has given me considerable additional knowledge, especially of the European species, and as it contains many of the types of Wiedemann, Meigen, Schiner, and Becker, it has enabled me to secure first hand information on those species. The Meigen types had been examined and reported upon by Dr. Becker,[1] but he did not select, nor designate, any type specimens, which procedure is very necessary in order to more firmly establish the status of the species. By Dr. Zerny's permission I am selecting and indicating the types in all possible cases.

Through the courtesy of the late Dr. Kertesz of the Musée National Hungrois, I was granted the privilege of working up a collection from that institution, mostly Oriental in origin, and this material is indicated thus [Hungary]. In addition to the above mentioned collections, I have been aided by material from C. F. Baker, through Dr. Mario Bezzi, [Baker], from Dr. Bezzi, [Bezzi], from Dr. J. Bequeart [Bequeart], from the United States National Museum, [U. S. N. M.], and others. By arrangements with the owners of the material, the Academy of Natural Sciences of Philadelphia has been able to secure by purchase and exchange considerable material, including many of the types of the species herein described, which is indicated by the initials of the institution [A. N. S. P.].

[1] Zeit. f. Hym. u. Dipt., 1902, pp. 209–355.

Subfamily Gymnopinae

This subfamily was proposed for the reception of those species with small mouth, generally narrow, prominent clypeus, and the posterior buccal area with a sharp posterior margin separating it from the concaved lower part of the occiput. Some of the Ephydrinae may have a sharp post-buccal margin, but the mouth and clypeus are large. The characteristics of this subfamily have been more fully discussed in my paper on the American species.[2]

The following ephydrid genera may be considered as belonging to this subfamily: *Hecamede*, *Placopsidella*, *Gymnopa*, *Cerometopon*, *Athyroglossa*. *Tetramerogastra?*, *Trimerogastra*, and probably *Hemicyclops* and *Stratiothyrea*. *Hemicyclops* Meijere, 1913, from description and figures by Meijere, would fall between *Hecamede* and *Placopsidella*, apparently more closely allied to the latter. *Stratiothyrea* Meijere, 1913, is probably allied to *Athyroglossa*, but I cannot secure very decisive characters from the original description and figures, although I have described a species, provisionally, in this genus.

The inclusion of some Indo-Australian species in this subfamily, not known at the time my American material was studied, necessitates the reconstruction of the generic concepts of *Gymnopa*, and *Athyroglossa*, while *Cerometopon* is almost invalidated. *Gymnopa* seems to hold well on the bare arista, but *Athyroglossa* will have to include *Ochtheroidea*. *Cerometopon* is known only from two neotropical species and is certainly closely allied to *Athyroglossa*.

HECAMEDE Haliday

1839. An. Nat. Hist., III, p. 224.

Genotype.—*Notiphila albicans* Meigen, 1830. [Monotypic.]

The species of this genus in many respects suggests those of the Discocerini, particularly in the arrangement of the frontal setulae and bristles, and in the aristal pectination, but the genus is certainly a member of the Gymnopinae, as is evident in its possession of the sharp post-buccal margination, as well as in some facial characteristics.

[2] Trans. Am. Ent. Soc., XLVII, pp. 325–343, (1922).

Hecamede albicans (Meigen)

1830. *Notiphila albicans* Meigen, Syst. Beschr. Eur. Zweifl., VI, p. 65.
1839. *Hecamede albicans* Haliday, An. Nat. Hist., III, p. 224.

This is a Palaearctic species apparently confined to southern Europe and northern Africa.

In the Vienna collection I found seventeen specimens of this species correctly determined, containing three males and four females labelled: (1) Marseilles (2) Coll. Winthem. These are, no doubt, part of the original typical series, and consequently I have selected and so labelled a male as the type, the remaining six as paratypes. The type has the tibiae entirely yellow, without infuscation. In addition to the type series I find other specimens from Europe, Gibraltar (head and abdomen missing), and Ras Shoab, Sokotra Island, det. Becker (fore tibiae somewhat infuscated medianly) [Vienna, 10]. I have also determined material from Trieste, Istria, (Handlirsch), [Vienna, 10].

Hecamede persimilis Hendel

1913. *Hecamede persimilis* Hendel, Supp. Ent., II, p. 99.

This species was originally described from Formosa and I have before me specimens from Tayao, Formosa, April to May, (Sauter), [Hungary, 5], which are apparently males. On comparison with the European *albicans*, the most evident distinguishing character is the smaller size of the shining facial tubercle, which is not larger than the shining spot at the base of the facials, while in *albicans* the median tubercular spot is more than twice their size.

I am not satisfied as to the validity of *nivea* Meijere[3] from Simalu, as a species distinct from *persimilis*, but Meijere feels sure that it is distinct, mainly on the more bluish-white color of the frons and thorax. My specimens of *persimilis* show variation in this respect, some decidedly yellowish, others with scarcely a trace of such. Meijere[4] records *albicans* from Java, which I am inclined to doubt.

[3] Tijd. v. Ent., LVIII, Supp. p. 61, (1915).
[4] Tijd. v. Ent., LVII, p. 248, (1914).

PLACOPSIDELLA Kertesz

1901. Kertesz, Term. Fuzet., XXIV, p. 424.
1912. *Oscinomima* Enderlein, Stet. Ent. Zeit., LXXXIII, p. 163. [Syn. Kertesz, 1912.]
1912. *Encastes* Lamb, Trans. Linn. Soc. London, (2), Zool., XV, p. 319. [Syn. present.]

Genotype.—*Placopsidella cynocephala* Kertesz, 1901. [Monotypic.]

In this genus we have much of the general habitus of *Gymnopa*, but the facial tubercle is vertically elongate, not round. The known species are opaque or sub-opaque. Through the kindness of the late Dr. Kertesz, I was privileged to examine a cotype of *cynocephala*, which has enabled me to definitely locate the genus.

Placopsidella cynocephala Kertesz

1901. *Placopsidella cynocephala* Kertesz, Term. Fuzet., XXIV, p. 425.
1912. *Encastes scotti* Lamb, Trans. Linn. Soc. London, (2), Zool., XV, p. 320, pl. XV, figs. 21–22.
1915. *Placopsidella liparoides* Meijere, Tijd. v. Ent., LVIII, Supp., p. 61.

This species was originally described from Seleo, New Guinea, a cotypic specimen of which series I have before me. It agrees exactly with the description of *Encastes scotti* from the Seychelles Islands, and there is little or nothing in the description of *P. liparoides* to convince me of its specific validity. It is probably a variety.

Regarding the species described as *Oscinomima signatella* Enderlein[5] from Formosa, Kertesz has studied the insect and recognizes it as a *Placopsidella* distinct from his *cynocephala*.

Among the material examined is a female labelled No. 1296.932, [Hungary], while other localities represented are: Batavia, Java, April, (Bryant & Palmer), [U. S. N. M., 3]; Seleo, Berlinhafen, New Guinea, (Biro), [Hungary, 1].

GYMNOPA Fallen

1820. Faun Suec., Oscin., p. 10.

Genotype.—*Syrphus subsultans* Fabricius, 1798.

The species of this genus are for the most part shining, with the arista bare, the facial tubercle is round and generally prominent in profile. I have been able to locate most of the species

[5] Stett. Ent. Zeit., LXXXIII, p. 164, (1912).

described, or which have been placed in this genus, except those of Walker, viz: *nigroaenea* and *tarsalis* from the United States, *gutticosta* and *infusa* from Borneo, all of which are unrecognizable from their descriptions.

Gymnopa subsultans (Fabricius)

1798. *Syrphus subsultans* Fabricius, Ent. Syst., IV, p. 304.
1805. *Eristalis subsultans* Fabricius, Syst. Antl., p. 246.
1805. *Mosillus arcuatus* Latreille, Hist. Nat. Crus. Ins., XIV, p. 390. [Syn., Schiner, 1864.]
1820. *Gymnopa aenea* Fallen, Faun. Suec., Oscin., p. 10. [Syn., Loew, 1848.]
1830. *Gymnopa subsultans* Meigen. Syst. Beschr. Eur. Zweifl., VI, p. 137.
1830. *Gymnopa nigra* Meigen, Syst. Beschr. Eur. Zweifl., VI, p. 137. [Syn., Loew, 1848.]
1856. *Glabrinus murorum* Rondani, Dipt. Prodr. Ital., I, p. 132. [Syn., Becker, 1905.]

In the Vienna collection I found one hundred and thirty-one specimens correctly determined, mostly from Austria, Bohemia Illyria, Merw-Oase, Turkestan, and Erdschias, Asia Minor. These have been determined by Schiner, Frauenfeld, Mik, and Egger, as *aenea, arcuatus*, and *subsultans*. In addition there were five specimens from Kiel, labelled, "aenea Coll. Wiedemann" of which one also bears a label "Eristalis subsultans Fb."; four specimens labelled "aenea Coll. Winthem," two "subsultans Coll. Winthem.," and one "nigra Coll. Winthem." Of the latter Becker[6] mentions nine ("9 Exemplare") in the Meigen material, although I find but one, which may be considered the type of *Gymnopa nigra* Meigen except that there are also specimens in the Paris Museum, according to Becker. I have not labelled this specimen as a selected type. Other specimens I have determined are from Austria, Albania and Sicily, [Vienna, 100].

Gymnopa beckeri new species

The type of this species I found placed under *Chlorichaeta tuberculosa* Becker. It is a true *Gymnopa*, differing from *subsultans* as follows: Antennae and all tarsi pale; frons with shallow pits at apex of frontal triangle; cheeks one-fourth height of eye; parafacial linear at fovea; scutellum flat, quadrate, densely

[6] Zeit. f. Hym. u. Dipt., II, p. 315.

scabrous. The general color is black with slight metallic tinge on thorax (damaged) and abdomen.

Type.— ♀ (?); Senaar, Egyptian Sudan, February 18–24, (Ebner, 1914), [A. N. S. P., no. 6352].

Gymnopa bracteatus (Schiner)

1868. *Mosillus bracteatus* Schiner, Nov. Reise, Dipt., p. 244.

This seems to be a true *Gymnopa*. The parafacial is broad, wrinkled in form of transverse pits just below a depressed granulose, more or less silvery, area opposite foveae; the median tubercle prominent, having acute angular profile with lower margin cut off at right angle with facial profile; thorax and scutellum densely granulose, metallic bluish green; abdomen concolorous but more shining; fore femora with several post-flexor spines which form a part of a gradating series with the more distal spinules. It is a larger species than *subsultans*, and thus differing from any other species known to me. Length.— 5 mm.

Type.—♀ (?); Cape of Good Hope, [Vienna National Museum Collection]. The typical series, as I found it, contained eight specimens, one of which is almost destroyed, one without abdomen, which with the other six I labelled type and paratypes.

Gymnopa grandis new species

This species is distinguished from *subsultans* by its opaque mesonotum and polleniferous face, and from *tibialis* by the position of the facial tubercle and the opaque mesonotum. The elongate thorax is also distinctive.

Black and mostly shining to polished. Antennae and tarsi, except apex of latter, pale; halteres black; wings clear with pale veins. Frons, mesonotum and scutellum sparsely brown pruinose; face whitish pruinose with following shining design: parafacial ridge from frons to oral margin, dots at bases of facials and hairs; meso-parafacial ridge from foveae to oral margin, round median tubercle and lower portion of foveae. Clypeus polished; cheeks shining but not polished. Mesonotum, scutellum and mesopleura, opaque, densely and finely shagreened. Bases of third and fourth abdominal segments cinereous. Femora and tibiae subopaque, brownish pruinose.

Frons and face broad; former with well-marked, shallow depressions medianly and laterally, above lunular margin. Face similar to that of *tibialis* but the shining tubercle round

and more than its diameter above epistomal margin, so that the median area of face is quite extensive below the tubercle; three to four facials present and distinct. Thorax more elongate than in either *subsultans* or *tibialis;* mesonotum densely setulose with bristles scarcely discernible. Scutellum robust, broader than long and broadly truncated apically; apicals parallel. Abdomen rounded; lateral margins strongly reflexed but not sharp nor revolute. Fore femora without flexor spines. Length.—3 mm.

Type.— ♀ (?); Takao, Formosa, June 24, 1907, (Sauter), [A. N. S. P., no. 6353].

Gymnopa dentifemur new species

This is not a typical *Gymnopa.* The face has no distinct median tubercle, but there is a large, shining, slightly wrinkled median convexity; the facialia are not sculptured; the fore femora are robust and with a broad, triangular post-flexor tooth. Otherwise in respects to vesture and structure the species is very similar to the American *tibialis.*

Black; tarsi except apex, pale; halteres pale; wings clear with pale veins. Shining to polished with upper surfaces, except that of abdomen, brownish-yellow pruinose. Frons smooth, more or less pruinose but mostly polished medianly; face cinereous with following pruinose markings: broad meso-parafacial margin, narrow line over bases of bristles, upper mesofacial convexity and oral margin. Cheeks and post-buccal area polished. Facialia not sculptured except slightly at insertion of bristles.

There are distinct verticals and ocellars, also, less distinct, proclinate and reclinate laterals; arista bare; facial tubercle not prominent but suggested as the apex of the conically convex median area; papilla are noticeable at bases of facials, but no impunctures are between them; median area somewhat wrinkled; parafacial smooth; cheek one-half height of eye. Thorax quadrate, mesonotum weakly granulose, densely setulose. Scutellum long and broad, slightly truncate at apex, with converging apicals. Abdomen polished with median basal cinereous areas on second to third segments; fifth segment subopaque. Femora and tibiae robust; fore femora strongly thickened, with a broad disto-medial post-flexor triangular tooth; fore tibiae normal; middle femora with complete series of strong anterior bristles. Length.—2.8 mm.

Type.—♂ (?); Mt. Hoozan, Formosa, May 1910, (Sauter), [A. N. S. P., no. 6354]. *Paratypes.*—2 specimens, topotypical; 1 specimen, Tainan, Formosa, February, 1909.

The following localities are also represented:

China: Shinkai Si, Mt. Omei, Szechuan, 4400 ft. alt., September 19, (D. C. Graham), [U. S. N. M., 1]. Suifu, Szechuan, Sept. 19, (D. C. Graham), [U. S. N. M., 1].

North West India, (Fischer), [Vienna, 2].

CHLORICHAETA Becker

1923. Denks. Acad. Wissench. Wien, xcviii, p. 73.

Genotype.—*Chlorichaeta tuberculosa* Becker, 1923 [Orthotypic].

This differs from *Gymnopa* in having the mesofacial area more pitted and less medianly tuberculose; the pits being lined with silver. It is more readily separated, however, by the presence of rounded pits on the parafacial along the groove (this area in *Gymnopa* is smooth or weakly wrinkled); the fore femora have a long post-flexor spur and a series of spinules distad of same.

Chlorichaeta tuberculosa Becker

1923. *Chlorichaeta tuberculosa* Becker, Denks. Acad. Wissensch. Wien, xcviii, p. 74, fig. 6.

This species was described from four specimens from Senaar, Atabasa, El Obeid, Khartum region, Egyptian Sudan. In the Vienna museum I found two specimens labelled Senaar, 18–24–II, of which one bearing a label "Ch. tuberculosa det. Becker" I have labelled "Type". This has the antennae missing and the abdomen damaged. The other specimen, apparently associated with the type and probably a part of the cotypic series of this species, but not bearing other than locality label, proves to be a new species (*beckeri*) of the genus *Gymnopa*. I am not aware of the location of the other two specimens of the cotypic series, and so cannot say whether or not they are conspecific with the above type.

The species differs from *Gymnopa albipennis* Loew, another member of this genus, in having the mesonotum and scutellum more granulose; the latter being flattened and more quadrate, and the third costal section longer, almost as long as the second. Before me is another specimen from Lorenço Marques, Portuguese East Africa, (C. H. Howard; Feb. 18. 1909), [U. S. N. M.].

Chlorichaeta albipennis (Loew)

1848. *Gymnopa albipennis* Loew, Stett. Ent. Zeit., IX, p. 14.
1864. *Mosillus albipennis* Schiner, Faun. Austr., II, p. 235.

This species was described from Messina, Sicily. Becker records it from Egypt[7], from Algeria[8], and from the Canary Islands.[9] Lamb[10] records it from the Seychelles and from Durban, Natal. Whether all these records are based on conspecific material may be questioned, as *tuberculosa* is very similar and has the same general appearance.

Correctly determined in the Vienna collection I found nine specimens, four from Sokotra Island, off the coast of Somaliland, and five from Egypt. Other specimens are before me from: Egypt, [Vienna, 4]; Elephantine Island, [Vienna 1]; Kaironam, Algeria, [U. S. N. M., 2]; Tunisia. [U. S. N. M., 1]; without data, labelled "n. sp. det. Schiner," [Vienna, 4]; labelled "Coll. Simony," [Vienna, 7]. These last eleven, determined by Schiner and Simony, are probably from Egypt or northern Algeria.

ATHYROGLOSSA Loew

1860. Neue Beitr., VII, p. 12.

Genotype.—*Notiphila glabra* Meigen, 1830, [Loew, 1860].

The more study given to this genus and to *Ochtheroidea* Williston, 1896, the more difficult it is to separate the two. As I have stated in my paper on the American species,[11] *Ochtheroidea* was established for a species which is more like the genotype of *Athyroglossa* than are some of its congeners, which fact has made the separation of the two genera always difficult, and the discovery of more species belonging to this group has made this apparently impossible. In the face of this situation it seems inadvisable to use *Ochtheroidea* until it can be satisfactorily characterized; nor is it advisable to recognize any of the more diverse species as bases of distinct genera.

In the present paper *Ochtheroidea* is ignored, and we consider *Athyroglossa* distinct from *Gymnopa* mainly on the pectinate

[7] Mitt. Zool. Mus. Berlin, II, p. 166, (1903).
[8] Zeit. Syst. Hym. u. Dipt., VII, p. 396, (1907).
[9] Mitt. Zool. Mus. Berlin, IV, p. 151, (1908).
[10] Trans. Linn. Soc. London, Zool., XV, p. 319, (1912).
[11] Trans. Am. Ent. Soc., XLVII, p. 325.

arista. However, the known species of this genus as thus considered will fall into two groups, based on the structure of the face. In one group the face is evenly and rather weakly convex; in the other it is strongly convex to medianly tuberculate. These groups may prove to represent two distinct genera, but I cannot use *Ochtheroidea* for either of them, and the erection of a new genus does not seem to be advisable at present, although we might consider *Athyroglossa ordinata* Becker as generically distinct from the other species, and from those in *Gymnopa*, mainly on the serial arrangement of the mesonotal setulae, but this species does not seem to offer other characters of sufficient importance to warrant such treatment.

Athyroglossa glabra (Meigen)

1830. *Notiphila glabra* Meigen, Syst. Beschr. Eur. Zweifl., VI, p. 69.
1860. *Athyroglossa glabra* Loew, Neue Beitr., VII, p. 12.

This species is found in both Europe and North America. Under this name in the Vienna collection I found thirty-nine specimens from Germany and Austria. Among these were two specimens labelled *flaviventris* which are no doubt part of the type series of that supposed synonym of *glabra*. In addition there were six specimens labelled "glabra Coll. Winthem," of which I make further mention below. The undetermined material in this collection yielded thirty-nine specimens from Austria, Bohemia, and Dalmatia.

Notiphila glabra was described from "Drei exemplare von Hrn. von Winthem." Becker states there are seven specimens, but he evidently included the *flaviventris* specimens. Of the six specimens labelled "Coll. Winthem," I found but two agreeing with the original description in having the "Beine schwarz; an den Vorderfüsser ist das erste Glied, . . . gelb." The other four have the basal segment black. We must, therefore, consider the first mentioned two as cotypes of *glabra*, and of these I have selected and labelled a male as the TYPE. The other four agree with the type of *Notiphila flaviventris* and are included in my treatment of that species. *Glabra* is smaller than *flaviventris* (2.5 to 3.75 mm.); the two basal segments of the fore tarsi, third and fourth of middle and hind tarsi, are white or yellow; frons broader than long, the delimiting line of the ocellar triangle extending nearly to the lunular margin;

ocellars, proclinate and reclinate laterals, well developed, the latter situated nearly midway between the vertical and anterior margins of the frons; post-ocellars well developed.

Athyroglossa flaviventris (Meigen)

1830. *Notiphila flaviventris* Meigen, Syst. Beschr. Eur. Zweifl., VI, p. 70.

Under *Athyroglossa glabra*, in the Vienna collection I found a male and a female labelled "flaviventris Coll. Winthem," which proved to be very distinct from the type of *glabra*. The female bears a hand-written label and this I selected as the TYPE, the other I labelled paratype. The collection also contained four specimens of this species labelled "glabra Coll. Winthem," and one labelled "giraudii det. Schiner," "Austria, Alte Sammlung." Among the undetermined material I found four more specimens of this species, and specimens of the same will probably be found in other collections under *glabra*, in fact I have received specimens from Prof. Bezzi determined as *glabra*.

Although Meigen described this species as "Beine glanzend Schwarz, mit gelben Füssen," he did not specifically state that the fore tarsi are yellow at their bases as he did in the case of *glabra*. This fact makes the resurrection of *flaviventris*, although not an appropriate name, very convenient. The present species does not greatly differ from *glabra*, and the color of the fore tarsi alone would not influence me in considering it distinct, but there are other characteristics which I consider of specific importance, viz:

Frons broad, about as broad as long, smooth and almost polished, without any relief marks except at the ocellar tubercle and the lateral vertical angles; ocellars, proclinate and reclinate laterals, very small and appressed, situated much nearer to the vertex than to the lunular margin of the frons; no post-ocellars, or they are very minute; fore tarsi are black with at most their extreme bases slightly paler; third to fourth basal segments of middle and hind tarsi yellow to white. A larger and more robust species than *glabra*, 3 to 3.5 mm., the six specimens averaging 3.25 mm. The pale venter with black spots described by Meigen are the ventral membrane and plates made conspicuous by the bloated condition of the abdomen.

Athyroglossa nudiuscula Loew

1873. *Athyroglossa nudiuscula* Loew, Beschr. Eur. Dipt., III, p. 307.

This and *Ochtheroidea melanderi* Cresson, described from California, are structurally identical, the latter differing in the paler tibiae. The two may be conspecific.

I have seen a specimen of the present species from Kula Ljums, Albania ? June 18, [Vienna].

Athyroglossa freta new species

Similar to the American *Ochtheroidea granulosa* Cresson, but larger, with broader cheeks, more prominent face, and less sculpturing.

Polished black with slight metallic tints; middle and hind tibiae and tarsi, yellow; fore tarsi and halteres, white; wings clear with dark veins. Scutellum faintly granulose. Cheeks broader than length of third antennal segment. Face one-half as broad as vertex, evenly convex below, granularly roughened medially with three minute bristle-bearing tubercles along the parafacials. Scutellum convex, triangular, with long apicals. Femora slender; fore femora with minute disto-medial post-flexor spines; fore tibiae dilated to as thick as fore femora. Second vein very long and parallel to third. Length.—2.5 mm.

Type.— ♀ ; Kankau, Formosa, April, 1912, (Sauter), [A. N. S. P. no. 6349].

Athyroglossa scabra new species

Black, including halteres, shining to polished. Third antennal segment and all tarsi, tawny to brown. Wings yellowish with pale veins which are darker basally.

Eyes oblique, elongate, Frons broader than long; ocellar bristles opposite anterior ocellus; frontal and orbitals well separated. Face one-half as broad as vertex, hemispherically concaved below antennae; lower portion convex with prominent medial tubercle, which is very pronounced in profile; pits along groove weak and scarcely discernible, two to three bristles on each side. Cheeks one-fourth as high as eyes. Clypeus projecting. Third antennal segment discoidal; arista with four to six hairs. Mesonotum scabrous, with numerous setulae which are not seriated. Scutellum similar, subquadrate, flat, broadly rounded apically; apical bristles tuberculose at bases, marginal hairs also tuberculose at bases; lateral bristles apparently missing. Abdomen broadly ovate; lateral margins revolute; fourth segment the longest; fifth very short. Fore femora thickened but

not armed below. Second costal section twice as long as third; third and fourth veins parallel or slightly converging. Length. —2 mm.

Type.—♂ (?); Sydney, New South Wales, Australia, 1900, (Biro), [A. N. S. P., no. 6350].

This species is similar to *Ochtheroidea centralis* Cresson, described from Central America, but it is more setulose and scabrous on the mesonotum and scutellum, as well as differing in other respects described above.

Athyroglossa evidens new species

Shining to polished black, more or less metallic blue tinged; fore tarsi white with apices darker; middle and hind tarsi, except apices, yellow. Halteres brown. Wings clear hyaline, veins dark.

Structurally similar to *A. glaphyropus* Loew, of North America. Face one-third as broad as vertex, lower convex portion transversely rugulose medianly, and pitted along the grooves; four to six bristles on each side. Cheeks narrow. Mesonotum and scutellum sculptured as in *glaphyropus*. Scutellum flat, triangular. Antennae and clypeus short. Abdomen narrower, more ovate. Second vein longer, parallel to third, so that the second costal section is much longer, nearly as long as the ultimate section of fourth vein.

Type.—♂ (?); Simbang, Huon Gulf, New Guinea, 1889, (Biro), [A. N. S. P., no. 6351].

Athyroglossa ordinata Becker

1896. *Athyroglossa ordinata* Becker, Berl. Ent. Zeit., XLI, p. 135.

In the Vienna collection I found six specimens of this species under *Gymnopa subsultans*, of which five were labelled "18870 Bgst. aeneus det. Bergenst," and one labelled "Vorarlberg, Bregenz., 9.8.85. Mik." In addition, the undetermined material contained ten specimens from Kula Ljumba, Albania?, and Balestrate, Sicily.

STRATIOTHYREA Meijere

1913. Bijdr. tot Dierkunde, XIX, p. 66.

This genus was erected for a species from Waigiou Island, near New Guinea. It is characterized by the suberect, tubercle-bearing scutellum and the thickened, dentate fore femora. Dr. Meijere recognized its relationship to *Athyroglossa* and

I do not doubt its membership in the Gymnopinae, although I have not seen the genotype, *S. femorata* Meijere, 1913.

Stratiothyrea browni new species

This species is probably not a typical member of the genus, but I include it here on the strength of the suberect, tuberculose scutellum; the fore femora and tibiae are, however, slender, and the abdomen is very long and slender. I suspect, judging from the wrinkled surface, that the type specimen is not fully hardened, and furthermore the general brown color may be due to the same cause; the fully matured insect probably is black instead of brown. The facial structure suggests *Athyroglossa glaphyropus*.

Black to brown, abdomen paler; halteres, fore coxae, most of basal portion of fore femora, four apical segments of fore tarsi, entire middle and hind legs including coxae, and ventral membrane of abdomen, white. Wings hyaline with pale veins. Antennae black; fore tibiae and basal segment of their tarsi, dark. Shining to polished; mesonotum and scutellum sparingly pale pollinose or subtomentose.

Head higher than long and higher than broad. Eyes vertical, constricted below, allowing ample post-buccal area; frons visible in profile at vertex only; face slightly prominent, gently convex; clypeus retreating. Frons one-third width of head, very short, twice as broad as long; inner verticals and the ocellars are the only bristles discernible on frons; the latter are situated just before the post-ocelli. Face one-third as broad as vertex; antennal depression not sharply defined; medial area slightly wrinkled, with four to five bristles each side on minute pimples; parafacial linear. Cheeks broad as length of third antennal segment, without bristle. Antennae situated well above center line of eyes, prominent; second segment with spine; third discoidal pubescent; arista long, with eleven to twelve long, close, curved hairs above.

Thorax quadrate with fore coxae attaining middle ones. Mesonotum convex, weakly and minutely roughened; setulae rather sparse and irregular; one short dorso-central; one noto-pleural. Scutellum flat, slightly broader than long, rectangular in outline, with the apical bristles nearly as widely separated as width of base of scutellum, very long and parallel, situated on distinct, rather elongate tubercles; no other bristles present. Abdomen much narrower than thorax, and longer; lateral margin revolute; entire surface wrinkled or so that the setulae appear to be on minute pimples (this may be a normal characteristic); second, third, and fourth segments long and subequal;

fifth short. Legs slender without noticeable spines or thorns on fore femora. Wings long and slender; second, third and fourth veins parallel; costa attaining fourth vein; alula narrow. Length. —5 mm.

Type.—♂ (?); Manila, Philippine Islands, (Robert Brown), [U. S. N. M. no. 28267].

Trimerogastra cincta Hendel

1914. *Trimerogastra cincta* Hendel, Suppl. Ent., III, p. 111.

This genus is apparently a member of this subfamily on account of the general structure of the head, but the second vein is short as in *Psilopa*, which character is also shared in some degree only by *Ochtheroidea centralis* and *Cerometopon lacunosum* Cresson, both from Central America. This feature is not a normal characteristic of the subfamily. I have seen a paratype of this species, which gives me some concept of the genus.

Subfamily Psilopinae

This subfamily is restricted to those species of the Notiphilinae of Loew having the lateral bristles of the frons proclinate and reclinate, never curving laterally over the eyes; face flat or convex, never truly tuberculose or setulose medianly; facialia paralleling the orbits; mouth relatively small; post-buccal area rounding into the occiput; no acrosticals nor dorso-centrals, but widely separated prescutellars may be present.

Of the genera known to me, the following belong to this subfamily: *Discomyza, Clanoneurum Peltopsilopa, Plagiops, Psilopa, Clasiopella, Leptopsilopa, Rhynchopsilopa, Ceropsilopa, Trimerinoides, Trimerina, Ditrichophora, Diclasiopa, Discocerina, Polytrichophora, Hecamedoides, Rhysophora, Actocetor, Glananthe, Allotrichoma, Elephantinisoma, Atissa, Atissiella.*

I will not attempt any critical discussion of the genera of this group, leaving most of such, particularly that most appropriate, to my next paper on the American species. However, it will be noticed from the above list of the genera, that *Notiphila, Paralimna* and *Ilythea* are not included. These with several others constitute my conception of the subfamily Notiphilinae, some of the genera and species of which will be, with a few remaining of the Psilopinae, considered in a subsequent paper.

Discomyza incurva (Fallen)

1823. *Psilopa incurva* Fallen, Faun. Suec., Hydr., p. 6.
1830. *Discomyza incurva* Meigen, Syst. Beschr. Eur. Zweifl., VI, p. 76.
1864. *Discomyza incurva* Bergenstam. Verh. Z.-B. Gesell. Wien, XIV, p. 713. [Metamorphosis.]

The Vienna collection contained seventy-three specimens of this species correctly determined, by Schiner, Frauenfeld, Egger, Bergenstam and Becker, mostly from Austria, Montenegro and Albania, including ten specimens labelled "Coll. Winth. incurva." Among the undetermined material in the above collection were thirty specimens mostly from Austria, Moravia and Montenegro. In addition to the above I have examined the following material:

AFRICA: Assab, Abyssinia, July, (Katona), [Hungary, 1]. Massawa, Eritrea, [Bezzi, 10].

The metamorphosis of this species has been noted by Dr. J. von Bergenstam. The puparium is found on the inner side of the shell of *Helix pomatia*.

Discomyza maculipennis (Wiedemann)

1824. *Notiphila maculipennis* Wiedemann, Anal. Ent., p. 57.
1830. *Homalura maculipennis* Wiedemann, Ausseur. Zweifl., II, p. 574.
?1860. *Discomyza obscurata* Walker, Proc. Linn. Soc. London, IV, p. 169. [Syn. Bezzi, 1914.]
1862. *Discomyza balioptera* Loew. Mon, Dipt. No. Amer., I, p. 140. [Syn., present.]
1867. *Discomyza pelagica* Frauenfeld, Verh. Z.-B. Gesell. Wien, XVII, p. 451. [Syn. present.]
1901. *Discomyza amabilis* Kertesz, Term. Fuzet., XXIV, p. 421, pl. XX, fig. 11. [Syn. Meijere, 1908.]
1908. *Discomyza maculipennis* Meijere, Tijd. v. Ent., LI, p. 166.

A well distributed species and a typical *Discomyza*, agreeing in structure with *incurva*, but differing mainly in the wing maculation, which is well illustrated by Kertesz.

The above synonymy is the result of the study of typical material. I have examined the types of Wiedemann, Loew and Frauenfeld. They are evidently the same species, representing possible slight variations which may occur in a series of any species. Its discovery in the West Indies, under *D. balioptera* Loew, is remarkable, but I cannot find any character of specific value by which Loew's type may be considered distinct from that of Wiedemann. The life history of this species, when known,

will probably account for this distribution, and furthermore the species will probably be found in many other maritime localities. Wiedemann originally described the species from the East Indies ("India orient"); Frauenfeld described it as a new species from the Nicobar Islands, and Kertesz did the same from Java. The material before me shows all intergradation in size from three to five millimeters in length, and in the amount of metallic tints on the face, while the aristal hairs vary from eight to ten in number.

In the Vienna collection I found a female bearing three labels: (1) "Ind. Orient. Coll. Winth.", (2) "Homalura maculipennis Wied, Ind. Orient," (3) "maculipennis det. Wied." This specimen is in good condition, is evidently Wiedemann's type, and is so labelled. It is a large specimen (5 mm.), with the face faintly metallic, and the arista with ten hairs. In the same collection I found a male bearing the following labels: (1) "Discomyza pelagica det. Frauenf.." (2) "Discomyza pelagica n. sp.," (3) "Novara-R." This is evidently the type of *D. pelagica* and I have so labelled it. Another male labelled: (1) "Novara-R. Nicobaren," (2) "pelagica Alte Sammlung," is probably a paratype, but I have not labelled it as such. In addition to the above, the following material has been examined:

Cuba: (including type of *Discomyza balioptera* Loew), [Mus. Comp. Zool., 4].

Guam: (D. T. Fulloway), [U. S. N. M., 2].

Philippine Islands: Mt. Makiling, Luzon, (Baker), [Baker, 7]. Dapitan, Mindanao, (Baker), [Baker, 2]. Manila, (Robt. Brown), [U. S. N. M., 4].

Formosa: Anping, June, (Sauter), [Hungary, 1]. Tainan, February, (Sauter), [Hungary, 1].

French Indo-China: Middle Annam, (Fruhstorfer), [Vienna, 4].

Clanoneurum cimiciformis (Haliday)

1855. *Discomyza cimiciformis* Haliday, Nat. Hist. Rev., Proc., II, p. 124.
1903. *Clanoneurum cimiciformis* Becker, Mitt. Zool. Mus. Berlin, II, p. 165.
1903. *Clanoneurum infumatum* Becker, Mitt. Zool. Mus. Berlin, II, p. 165. [Syn., present.]
1913. *Clanoneurum orientale* Hendel, Suppl. Ent., II, p. 97, figs. 5–6. [Syn., present.]

I strongly suspect the synonymy of *infumatum*, described from the saline lakes of northern Egypt, also of *orientale* described from Formosa. I have *cimiciformis* from saline lakes and marine beaches of the United States, and have seen a specimen from Trieste, (Handlirsch), [Vienna, 1].

Plagiops aciculata (Loew)

1862. *Psilopa aciculata* Loew, Mon. Dip. N. A., I, p. 142.
1868. *Ephygrobia metallica* Schiner, Nov. Resa, Dip., p. 242. [Syn., present.]

The examination of the type of *Ephygrobia metallica* in the Vienna collection establishes the above synonymy. I found four specimens labelled: (1) "Lindig 1864, Venezuela," (2) "metallica, Alte Sammlung"; three with abdomen in rather damaged condition; one specimen with this missing. I selected and labelled TYPE, the specimen bearing the handwritten label, "Ephygrobia metallica Sch." it being in the best condition; the others were labelled, paratype.

Psilopa polita (Macquart)

1835. *Hydrellia polita* Macquart, Hist. Nat. Ins., Dipt., II, p. 524.
1860. *Psilopa polita* Loew, Neu. Beitr., VII, p. 10.

In the Vienna collection were found nine specimens from Germany, Austria and Hungary, correctly determined. In addition, under *nitidula* there were four specimens of this species labelled "compta det. Egger." Among the undetermined material in that collection I found seventy-five specimens from Austria, Bohemia, Moravia and Illyria.

This species has the face polished, convex; antennae black, at most base of third segment pale; legs black with tarsi sometimes pale; wings immaculate. The face is, at least, twice as long as broad; the convex medial area extends the full length of face, is polished, leaving the facialia and parafacials sparsely, but distinctly, pruinose.

Psilopa rufipes Hendel

1913. *Psilopa rufipes* Hendel, Suppl. Ent., II, p. 97.

This species apparently belongs near *polita*. The material before me does not show the milky wings described by Hendel. Originally described from Formosa.

Black; halteres white; antennae, legs including coxae, tawny. Wings hyaline, slightly infuscated basally; veins yellow. Shining apices with metallic blue to bronze tints.

Head one and one-half times as broad as high. Frons twice as broad as long, one-third width of head. Face one-half as broad as vertex, twice as long as broad, evenly convex, polished blue with the linear parafacial dark brown; bristle at lowest third of profile, with one or two hairs below. Cheeks hardly as broad as third antennal segment, with stout bristle. Antennae prominent; third segment subconical, one and one-half as long as broad; arista with nine hairs. Mesonotal setulae in well separated series.

The following material is before me:

Formosa: Tainan, April to October, (Sauter); Takao, March, (Sauter), [all Hungary, 3].

Philippine Islands: Los Baños, (A. C. Baker); Mount Makiling, Luzon, (A. C. Baker), [all Baker]. Manila, (Robt. Brown), [U. S. N. M., 11].

New Guinea: Simbang, Huon Gulf, (Biro), [Hungary, 1].

Psilopa singaporensis Kertesz

1901. *Ephygrobia singaporensis* Kertesz, Term. Fuzet., xxiv, p. 81.
1913. *Psilopa singaporensis* Hendel, Suppl. Ent., ii, p. 97.

This species is very similar to *polita* in general habitus. The antennae are pale except third segment above; fore legs entirely black with middle and hind tarsi pale. Wings somewhat darkened basally. Face as in *flavimanus*, but narrower; fore tarsi somewhat dilated. The specimens noted below from New Guinea have the middle and hind tibiae pale. The species was originally described from Singapore. and has been recorded from Formosa and Java. The following material has been examined:

Philippine Islands: Los Baños, [Baker, 1].

New Guinea: Friedrich Wilhelmshafen, 1898, (Biro), [Hungary, 9]. Stephansort, Astrolabe Bay, 1900, (Biro), [Hungary, 2].

Psilopa mentita new species

This is also a member of the *polita*-group, and is very similar to my conception of *singaporensis*. The antennae are, however, darker and third segment not as long; fore legs black with tarsi not dilated; wings not darkened basally; middle and hind tibiae pale apically; antennae dark with base of third segment pale. The black fore tarsi is unusual in this genus.

Type.—♂; Middle-Annam, (Fruhstorfer), [A. N. S. P., no. 6355]. *Paratypes*.—2 ♂, 4 ♀; topotypical, [Vienna and A. N. S. P. collections].

Psilopa flavimanus Hendel

1913. *Psilopa flavimanus* Hendel, Suppl. Ent., II, p. 97.

Another species of the *polita*-group. The entire surface is polished and metallic tinged; the mesonotum and scutellum are, at most, very sparsely brown pollinose. Face convex, highly polished; antennae, apex of femora, tibiae, and tarsi, pale; halteres yellow; wings immaculate.

Originally described from Formosa. I have examined material from:

INDIA: Bombay, 1902, (Biro), [Hungary, 1.]

FRENCH INDO-CHINA: Middle Annam, (Fruhstorfer), [Vienna, 3].

Psilopa compta (Meigen)

1830. *Notiphila compta* Meigen, Syst. Beschr. Eur. Zw., VI, p. 68.
1860. *Psilopa compta* Loew, Neue Beitr., VII, p. 9.

This species is apparently Holarctic in distribution, as I have it from the United States. The face is similar to that of *nitidula*, but is more densely pollinose, although showing faint metallic tints; antennae pale with apex of third segment somewhat darker; all tibiae and tarsi, and apex of femora, yellow; or fore and hind tibiae sometimes dark medially; wings immaculate.

I found under *nitidula* in the Vienna collection, what is evidently the type of *compta*, a male bearing label, "compta Coll. Winthem," which specimen I labelled TYPE. It is in good condition. Becker[12] mentioned having seen five specimens of this species in the Vienna collection, but I did not find any specimens under this name. Apparently he did not consider the species distinct from *nitidula*. However, under *nitidula* I found the following specimens belonging here: two labelled, "madizans Coll. Winthem," one, as "compta det. Bergenst.," and one as "E. nitidula Coll. Mik."

Among the undetermined material in the Vienna series, I found thirty-three specimens from Austria, Ilyria, Slovakia, Elba Island, Tashkend, Turkestan, (Ledi), and Turcomania (Reitter, Ledi).

Psilopa nilotica (Becker)

1903. *Ephygrobia nilotica* Becker, Mitt. Zool. Mus. Berlin, II, p. 157.
1907. *Psilopa nilotica* Bezzi, Bull. Soc. Ent. Ital., XXXIX, p. 189.

[12] Zeit. f. Hym. u. Dipt., II, p. 296.

This species appears to be the common Egyptian species of the genus. Becker[13] says it is not scarce in the entire Nile region. In the Vienna collection I found six specimens of the series recorded by Becker from the Zoological Gardens of Khartoum. Bezzi, 1907, has recorded it from Eritrea.

If the specimens before me are correctly determined, this species is similar to *compta*, but has the femora and coxae pale.

Psilopa apicalis (Perris)

1847. *Hydrellia apicalis* Perris, Mem. Acad. Sci. Lyons, II, p. 494.
1860. *Psilopa apicalis* Loew, Neue Beitr., VII, p. 9.

In this species the face and antennae are as in *compta*, with the fore tibiae and tarsi sometimes darkened, especially the tibiae medially. The wings have a distinct cloud at apex.

Under this name in the Vienna series I found seven specimens correctly determined by Frauenfeld, Schiner, and Bergenstam, also with these a specimen of *Discocerina plumosa*. Among the undetermined material I found two specimens from Salsburg, Austria, (Mik).

Psilopa nitidula (Fallen)

1813. *Notiphila nitidula* Fallen, Handl. Svenska Vet.-Akad., XXXIV, p. 252.
1823. *Psilopa nitidula* Fallen, Dipt. Suec., Hyd., p. 7.

This species has the face weakly convex to nearly flat, entirely and sparsely pollinose; antennae pale with apex of third darkened; fore legs dark with apex of tibia and tarsi rarely pale; middle and hind tibiae and tarsi, pale; wings immaculate.

In the Vienna collection under this name I found fourteen specimens correctly determined by Wiedemann, Schiner, and Mik, also the following specimens belonging to other species; three specimens as "compta det Egger," one as "compta Coll. Winthem," two as "madizans Coll. Winthem," one as "compta det Bergenst.," and one as "nitidula Coll. Mik." all of which prove to be *compta* Meigen. In addition, there were four specimens as "compta det Egger" which proved to be *polita* Macquart.

Among the undetermined material from Vienna there were twelve specimens from Austria and Elba Island.

[13] Denksch. Acad. Wissen. Wien, XCVIII, p. 72.

Psilopa leucostoma (Meigen)

1830. *Notiphila leucostoma* Meigen, Syst. Beschr. Eur. Zw., VI, p. 68.
1844. *Psilopa leucostoma* Stenhammar, Handl. Svenska Vet.-Akad., 1844, p. 263.

The Vienna collection had seven specimens of this species correctly named by Schiner, including a male "leucostoma Coll. Winthem," which is evidently the type and I so labelled it. The left wing is missing and the mesonotum is damaged, but otherwise it is in good condition. In addition there were five specimens labelled "leucostoma Coll. Winthem," and one "det. Schiner," all of which proved to belong to the genus *Scatella*.

Among the undetermined material I found twenty-five specimens, mostly from Austria.

Psilopa maritima (Perris)

1847. *Hydrellia maritima* Perris, Mem. Acad. Sci., Lyons, II, p. 494.
1873. *Psilopa maritima* Loew, Beschr. Eur. Dipt., III, p. 306.

This species is structurally similar to, and is probably congeneric with, the American *Trimerina adfinis* Cresson. It is distinguisbed by the hyaline, black banded or spotted wings.

Two specimens are before me, from "Gallia," determined by Schiner, [Vienna].

Clasiopella uncinata Hendel

1914. *Clasiopella uncinata* Hendel, Suppl. Ent., III, p. 110.

This is the genotype, of which I have two specimens from Anping, Formosa, (Sauter) [A. N. S. P.].

Under this genus I am including several species which, although showing much in common with the genotype, may not be congeneric. They, however will not go more readily into any other genus, and it would be inadvisible to consider erecting new ones for their reception. The species at present placed here may be distinguished from those of *Psilopa* by the more or less spherically convex mesofacial area. This convexity differs from that present in some species of *Psilopa* in being limited to the upper part of the face, and also in forming a part of a sphere, not of a cylinder.

Clasiopella dimidiata (Cresson)

1922. *Psilopa dimidiata* Cresson, Ent. News, XXXIII, p. 137.

I cannot find any structural or color differences between the type of this species from North America and a specimen from

Tainan, Formosa, (Sauter), [A. N. S. P.] except that the third costal section is longer, nearly as long as the second. *Psilopa incerta* Becker, 1924,[14] appears very similar but the tibiae and tarsi of that species are described as brown, which is not the case here.

Clasiopella nervimaculata (Becker)

1910. *Ephygrobia nervimaculata* Becker, Denkschr. Acad. Wissen. Wien, LXXI, p. 154.

The two type specimens of this species, both males, I found in the Vienna Collection, labelled, type and paratype, from Aden, Arabia, December, 1898, (O. Simony). The species is similar to *dimidiata* but the legs, including the coxae are pale, and the posterior cross-vein has a faint, small cloud.

Clasiopella girschneri (v. Roeder)

1889. *Psilopa girschneri* v. Roeder, Ent. Nachr., XV, p. 54.

The examination of a specimen of this species in the Vienna Collection, without locality, labelled, "Psilopa girschneri Roeder," revealed the fact that I have specimens of the same species from the United States.

Trimerina madizans (Fallen)

1813. *Notiphila madizans* Fallen, Hand. Svenska Vet.-Akad., XXXIV, p. 252.
1835. *Trimerina madizans* Macquart, Hist. Nat. Ins., Dipt., II, p. 529.
1830. *Notiphila nigella* Meigen, Syst. Besch. Eur. Zweifl., VI, p. 72. [Syn., Stenh., 1844.]
1830. *Notiphila rufipes* Meigen, Syst. Beschr. Eur. Zweifl., VI, p. 71. [Syn., Becker, 1902.]

The presence of some specimens of *compta* Meigen, labelled "madizans Coll. Winthem," seems to indicate that Meigen was not very familiar with this species, although he did recognize it twice as his new species *nigella* and *rufipes*.

In the Vienna collection I found eighteen specimens under this name, among which are the following: (1) one male and three females as "rufipes Coll. Winthem," of which I selected and labelled the male as the TYPE; it is in good condition. The other male and the females are labelled paratypes, one of which has the head missing; (2) one male, marked, "nigella Coll. Winthem," which I labelled TYPE, is in good condition except that the tibiae and tarsi are missing.

[14] Ent. Mitt., Berlin, XIII, p. 91.

Among the undetermined material I found eighteen specimens, mostly from Austria.

Leptopsilopa mutabilis new species

This species probably represents a new genus, the limits of which I will not attempt to suggest at present. The form of the thorax is much like that of the members of *Psilopa*, while the absence of true ocellars (which apparently are replaced by the strong, erect, diverging bristles between the posterior ocelli) is more characteristic of *Plagiops* and *Ceropsilopa*, but the closely situated, *Psilopa*-like antennae are not characteristic of *Ceropsilopa* nor is the general habitus suggestive of *Plagiops*. Therefore, until our knowledge of this group is more extensive, it seems best to retain the species, at least tentatively, in *Leptopsilopa*.

Black; antennae and mouth parts, brown; halteres and the two basal segments of fore tarsi, white; middle and hind tibiae and their tarsi except apices, yellow; wings hyaline, yellowish tinged; veins pale. Highly polished species, especially the pleura and apex of abdomen, metallic tinged. Face below, mesonotum and scutellum, more or less microscopically rugose.

Eyes vertical. Frons broader than long, strongly depressed at antennae; orbits strongly converging to the narrow face; a pair of strong, erect, diverging bristles between posterior ocelli; no true ocellars. Face one-half as broad as vertex, four times as long as broad, in profile, evenly convex, retreating below, extending far below line of buccal orbits, flattened above, with parafacials linear, and groove distinct; one stout bristle at middle of profile, with a few hairs below, all situated in minute pits along the groove. Clypeus narrow. Cheeks as broad as length of third antennal segment. Antennae short, situated above center-line of head, and far above that of eyes; second segment as in *Psilopa*, with spine short and slender; third segment slightly longer than broad; arista with seven hairs. Thorax quadrate; sternopleura short with fore coxae attaining base of middle ones; mesonotum convex; setulae in distinct, well separated series; prescutellars nearly the length of scutellum before base of latter. Scutellum triangular, long as broad, pointed, flat. Abdomen with lateral margins revolute; fourth segment twice as long as third; fifth one-half as long as fourth. Second and third costal sections subequal; third and fourth veins parallel. Length.—2 mm.

Type.—♀ (?); Manila, Philippine Islands, (Robert Brown), [U. S. N. M., no. 28268].

Leptopsilopa pollinosa (Kertesz)

1901. *Ephygrobia pollinosa* Kertesz, Term. Fuzet., XXIV, p. 81.
1913. *Psilopa pollinosa* Hendel, Suppl. Ent., II, p. 97.

This species has considerable Indo-Australian distribution. It is structurally similar to the known species of *Leptopsilopa*, but the face is much narrower and the fore tarsi are not noticeably dilated.

The species was originally described from Singapore. Hendel recorded it from Formosa, while I have the following localities represented before me:

CEYLON: Henaratogoda, February, (Uzel), [Vienna, 1].
INDIA: Bombay, (Biro), [Hungary, 1].
FORMOSA: Pilan, August, (Sauter), [A. N. S. P., 1].
NEW GUINEA: Friedrich Wilhelmhafen, (Biro), [Hungary, 2].
AUSTRALIA: Brisbane, Queensland, (Biro), [Hungary, 9].
SAMOAN ISLANDS, [Vienna, 1].

Rhynchopsilopa magnicornis Hendel

1913. *Rhynchopsilopa magnicornis* Hendel, Suppl. Ent., II, p. 96.

The genus *Rhynchopsilopa* is allied to *Ceropsilopa*, distinguished by the shape of the head, in which the frons are horizontal, the face vertical, very long, with the antennae situated far above the center line of the eyes; there are no reclinate frontals, and the face is weakly convex.

This species was originally described from Formosa. I have examined two specimens from Polisha, Formosa, December, (Sauter), [Hungary].

Ceropsilopa decussata new species

This species differs from the others of the genus by having the facial bristles low, below the line of the buccal orbit. It is similar in this respect to an undescribed species from the United States.

Black; apex of second antennal segment, palpi, halteres, wings and veins, legs including coxae and tarsi, yellow. Almost entirely whitish pollinose, which does not obscure the shining, often metallic tinged surface. Face strongly convex, but weakly so in profile; lunule not depressed; second antennal segment with a suggestion of a superior callous; spine short; ocellars situated between anterior and posterior ocelli. Length. —1.5 mm.

Type.—♀; Tainan, Formosa, April, 1909, (Sauter), [A. N. S. P., no. 6356]. *Paratype.*—1 ♀; topotypical, [Hungary].

Ceropsilopa tenuicornis new species

This species seem to be almost congeneric with *Clasiopella erratica* described from the United States, but the antennae are longer, as in *Ceropsilopa*, and it suggests a closer relationship with the known species of the latter than with those of *Clasiopella*

Shining black; apex of proboscis and all tarsi except apices, yellow; femora and tibiae, black; halteres white. Wings hyaline with pale veins. Frons and face polished; face nearly as broad as vertex and nearly as broad as long, subspherically convex above, distinct in profile, with a transverse depression above epistoma; two fine bristles on lower third of profile. Cheeks broader than third antennal segment. First segment of antennae visible; second long as broad with slight angle above, bearing the long spine; third segment slender, twice as long as second, three to four times as long as broad; arista with eight hairs. Scutellum large, flat, bare. Second and third costal sections subequal. Length.—2 mm.

Type.—♂ (?); Brisbane, Queensland, Australia, 1900, (Biro), [A. N. S. P., no. 6357].

Ceropsilopa opulens new species

This and the following species differs from the more typical species of the genus in having the face evenly and more weakly convex, not prominent in profile, very much suggesting the species of *Plagiops*.

Shining, metallic blue to yellowish; halteres white; antennae except apex of third segment, middle and hind tarsi except apices, pale, yellowish; wings and veins yellowish. Face highly polished, narrow with one bristle, low; mesonotum and scutellum micro-rugulose. Antennae typical; third segment three to four times as long as broad; arista with ten hairs.

Type.—♀; Madagascar, [A. N. S. P., no. 6358]. *Paratypes.*—3 ♂, 2 ♀; topotypical, [Vienna].

Ceropsilopa bidigitata new name

1916. *Psilopa longicornis* Meijere, Tijd. v. Ent., LIX, p. 266 [nec Lamb, 1912].

This species is very similar to *opulens*, but the legs are yellow excepting fore tibiae and tarsi, which are black; frons are micro-rugulose; scutellum and mesonotum more rugulose, while the

more elongate abdomen is faintly so. The fourth and fifth veins and the posterior cross-vein are dark. Dr. Meijere's original description is very good.

The species was originally described from Batavia, Java. I have before me a female from Peradeniya, Ceylon, May, (Dr. Uzel), [Vienna].

Pelex purimana new genus and species

Black; middle and hind tarsi, yellow; second antennal segment brown; halteres and fore tarsi white; wings hyaline with pale veins. Shining species with face and abdomen somewhat polished; mesonotum and scutellum finely punctured.

Head higher than long; eyes vertical with orbits sharply emarginated at antennae; cheeks narrow, about as broad as third antennal segment. Frons more than twice as broad as long, areas not differentiated. Face convex, two-thirds as broad as vertex, twice as long as broad; one bristle at lower third of profile. Antennae are very long, widely separated, situated in a transverse depression which extends full width of frons; spine of second segment long; third segment nearly as long as face, four times as long as broad; arista with eight hairs. Scutellum flat, as long as broad. Third abdominal segment longer than first and second together; fourth as long as second and third. Second and third costal sections subequal. Length.—1.3 mm.

Type.—♂; Manila, Philippine Islands, (R. Brown), [U. S. N. M., no. 21846].

DISCOCERINA Macquart

1835. Macquart, Hist. Nat. Ins., Dipt., II, p. 527.

Genotype.—*Notiphila obscurella* Fallen, 1813, as *Notiphila pusilla* Meigen, 1830. [Coquillett, 1910.]

The species of this genus have the mesonotal setulae, generally, irregularly arranged; the ocelli are distinctly removed from the sharp vertex; the upper part of the face is bifoveolate, medially carinate, with two or three subequal bristles below on each side of the convex portion below; third antennal segment is seldom longer than broad.

There are probably several distinct genera represented in the species now included in the genus. Hendel recently separated two, *Diclasiopa* and *Hecamoides*, both of which will be recognized in a subsequent paper of this series.

Discocerina obscurella (Fallen)

1813. *Notiphila obscurella* Fallen, Handl. K. Svenska Vet.-Akad., 1813, p. 251.
1830. *Notiphila nigrina* Meigen, Syst. Beschr. Eur. Zw., VI, p. 69. [Syn. Haliday, 1839.]
1830. *Notiphila pusilla* Meigen, Syst. Beschr. Eur. Zw., VI, p. 71. [Syn., Becker, 1902.]
1830. *Notiphila tristis* Meigen, Syst. Beschr. Eur. Zw., VI, p. 72. [Syn., Becker, 1902.]
1862. *Discocerina parva* Loew, Mon. Dipt. N. Amer., I, p. 146.

This seems to be a very variable species, especially in the width of the parafacials and cheeks, and in the number of setulae (5–8) on the former, but there seems to be no differentiation that can be considered of specific value. After examining the series in the Vienna collection and comparing the same with an extensive series from North and South America, I must acknowledge the synonymy of *parva* Loew, which I cannot consider even a subspecies.

Of this species I found twenty specimens in the Vienna collection, mostly from Austria and Sweden, correctly determined. In addition I determined fifty-three specimens in the Vienna material, mostly from Austria, Bavaria, and Dalmatia; three, from Mendoza, Argentina [in poor condition], and Costa Rica, (Kundsen, 1920). The following typical material was examined:

Notiphila nigrina Meigen.—Becker mentions two specimens in Vienna, none in Paris. I find two females labelled "nigrina Coll. Winth.," of which I have selected the best preserved specimen and labelled it TYPE. The other, paratype, has the antennae missing.

Notiphila pusilla Meigen.—In the Vienna collection I find a male in good condition, labelled (1) "pusilla Coll. Winth.," (2) "pusilla." This is no doubt the specimen mentioned by Becker, and is probably the type or one of the typical series, although it does not agree in all respects with Meigen's description. This specimen has the middle and hind tibiae black, while the original description calls for the "Schienen und Füsse ganz gelb." However, I think we can label this TYPE without committing an injustice. This specimen is not in perfect agreement with *nigrina* nor *tristis* in the following respects:

Thorax black, somewhat shining, not grayish nor ochraceous; the areas of the head are likewise free from dustings; middle and hind tibiae black to their extremities. Structurally there is no difference of note, and I suspect that the differences here given are due to some greasiness, although this is not otherwise evident.

Notiphila tristis Meigen.—I find in the Vienna collection a male bearing labels (1) "tristis Coll. Winth.," (2) "tristis," which is certainly conspecific with *obscurella* as represented by the material examined, but I cannot agree with Meigen's description "Matt schwarzgrün," unless the faint bronze ground color is referred to. Again the phase "Die Beine sind helgelb, mit schwarzen Schenkeln" describes the femora as dark with the tibiae and tarsi yellow; while this specimen has only the tarsi yellow. Meigen seems to have made the same error regarding *pusilla*. This specimen is in good condition and I have labelled it TYPE.

Discocerina plumosa (Fallen)

1823. *Notiphila plumosa* Fallen, Dipt. Suec., Hydr., p. 9.
1860. *Psilopa plumosa* Loew, Neue Beitr., VII, p. 10.
1864. *Ephygrobia plumosa* Schiner, Fauna. Austr., II, p. 242.
1894. *Clasiopa plumosa* Strobl, Mitt. Nat. Ver. Steierm., 1893, p. 125.
1911. *Discocerina plumosa* Collin, Ent. Mon. Mag., XLVII, p. 183.

I am not convinced of my determination of this species. My conception is based on Schiner's determinations of the specimens in the Vienna collection. The species is black, generally brown to grayish pruinose, but nowhere dense enough to completely obscure the shining surfaces; halteres and tarsi yellow, and third antennal segment more or less brown. The face is ample and flat, brown pruinose in the male, grayish in female, with two bristles on each side, and scarcely any foveae above.

In the Vienna collection I found twenty-two specimens under this name, of which two, labelled *plumosa*, and one labelled *cinerella*, proved to be *calceata*, and another labelled *plumosa* proved to belong to the genus *Hydrellia*. The remaining nineteen were correctly determined. Under *Psilopa apicalis*, and *Clasiopa calceata*, each, was found a specimen belonging here. Among the undetermined material I found six specimens from Austria.

Discocerina aurifacies (Strobl)

1893. *Clasiopa aurifacies* Strobl. Wien. Ent. Zeit., XII, p. 255.

A male and female of this species from Monreale, Sicily, May 14, (Zerny), was determined from the Vienna material as agreeing with Strobl's good description.

Discocerina bohemanni (Becker)

1896. *Clasiopa bohemanni* Becker, Berl. Ent. Zeit., XLI, p. 159.
1910. *Clasiopa aurifacies* var. Strobl. Mitt. Nat. Ver. Steierm., XLVI, p. 206.

A female from Freistadt, Austria, April 1, (Handlirsch), [Vienna, 1], seems to agree with the original description, and on comparing it with the female of *aurifacies* I find it is more densely gray; the brown of the mesonotum more distinct; eyes bare or very sparsely pilose; face more flattened, densely gray; frons and face of about equal width; third antennal segment and palpi entirely brown. Length.—3 mm.

The species was originally described from a female in the Bohemann collection, and Strobl considers it merely a variety of *aurifacies*, but I do not concur in this. However, a good series of both forms and a more critical examination of the types may permit of more definite conclusions.

Discocerina pulchella (Meigen)

1830. *Notiphila pulchella* Meigen, Syst. Beschr. Eur. Zweif., VI, p. 70.
1835. *Hydrellia pulchella* Macquart, Hist. Nat. Ins., Dipt., II, p. 525.
1896. *Clasiopa fulgida* Becker, Berl. Ent. Zeit., XLI, p. 156. [Syn., Becker, 1902.]
1909. *Discocerina pulchella* Czerny, Verh. Zool.-Bot. Ges. Wien, LIX, p. 268.

In the Vienna collection I found a male labelled, (1) "pulchella Coll. Winth." (2) "pulchella," in fair condition and agreeing with its description, and it is herewith designated TYPE.

Among the undetermined Vienna material I located two females from Klosterneuburg, Austria, and two more of same sex from Vienna, Austria, (Mik). This sex has the fore tibiae somewhat dark medially. I concur in Becker's synonymyzing of *Clasiopa fulgida*. This species is also before me from North America.

Discocerina calceata (Meigen)

1830. *Notiphila calceata* Meigen, Syst. Beschr. Eur. Zweif., VI, p. 69.
1844. *Clasiopa nigrina* Stenhammar, Handl. Svensk. Vet.-Akad., 1844, p. 258. [Syn., Haliday, 1856.]
1839. *Discocerina calceata* Haliday, Ann. Nat. Hist., III, p. 224.

In the Vienna collection I found a female in good condition labelled, (1) "calceata Coll: Winth." (2) "calceata." This is the specimen Becker notes as lacking the antennae. I have labelled it TYPE. Under *Clasiopa plumosa* there were four specimens belonging here. In addition I found eight specimens correctly determined and among the undetermined material, thirty-three specimens mostly from Germany and Austria.

This is a robust, shining species, with mesonotum and scutellum brownish; frons sparingly brown pruinose, the remaining surfaces sparsely gray to white pruinose. Face nearly as broad as frons; foveae and carina distinct but rather weak; the lower two-thirds of face convex.

Discocerina olivacea (Becker)

1896. *Clasiopa olivacea* Becker, Berl. Ent. Zeit., XLI, p. 155.

In the Vienna material I find a male labelled "Coll. Winth.," without other data, which I consider this species. It is very similar to *calceata* (not to *plumosa* as emphasized by Becker), but more opaque; the frons and mesonotum rather densely ochreous-gray, not contrasting with the pleural surfaces; the convex portion of the face is not so long, in the specimen examined.

Discocerina palliditarsis (Becker)

1896. *Clasiopa palliditarsis* Becker, Berl. Ent. Zeit., XLI, p. 155.
1830. *Notiphila albifrons* Meigen, Syst. Beschr. Eur. Zweifl., VI, p. 70, [nec. Fallen, 1813].

A female in the Vienna collection labelled (1) "albifrons Coll. Winth.," (2) "albifrons," is, according to Becker,[15] conspecific with his *Clasiopa palliditarsis*. Judging from the original description of *Notiphila albifrons* Fallen, "nigra nitida, clypeo argenteo, tarsis omnibus albidis," the insect is shining black with silvery face and pale tarsi, and furthermore in his Fauna Suecia, Fallen states that the pleura (pectus) is sericeous white. These descriptions cannot apply to the form Meigen described, nor to the specimen above referred to in the Vienna collection. Stenhammar and several later students considered *albifrons* Fallen a member of the genus *Hydrellia*, which is probably correct. On the other hand *Notiphila albifrons* Meigen, being

[15] Zeit. f. Hym. u. Dipt., II, p. 236.

preoccupied by that of Fallen, allows us to use Becker's name and consequently eliminates the ambiguity caused by Meigen's evident misidentification.

In the Vienna material I found two females of this species from Salsburg, Austria, (Mik).

DESCRIPTIONS OF FOUR NEW NEOTROPICAL DIPTERA

BY C. H. CURRAN
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Representatives of three of the species described in the following pages were contained in material received for determination from the Academy of Natural Sciences, Philadelphia, Pennsylvania, and type material will be found in the Academy collections.

Asilidae

Deromyia nigricauda new species

Related to *D. coffeatus* Wiedemann, but the legs are rusty reddish yellow, the dorsal half of the posterior tibiae and tarsal apices ferruginous or black.

Length, 22 to 24 mm. *Male.* Head rusty yellowish, clothed with whitish pollen on the face and lower portion of the occiput. Mystax composed of whitish or yellowish tinged bristles in a shallow triangle, those above the oral row much weaker. Beard white or very pale yellowish; bristles behind the eyes pale below, becoming brown above. Proboscis shining brown, with basal third reddish, the hairs yellow; palpi reddish, with yellow bristles and a few black ones intermixed. Antennae reddish yellow, the third segment reddish brown; antennal bristles brown; third segment bristly above on the basal half.

Thorax reddish brown; mesonotum brown, from posterior view with a pair of moderately separated golden median vittae which connect along the suture and along the humeri with the golden pollinose lateral margins; pleura with more greyish pollen which has a brassy tinge or is even quite brassy, the mesopleura, however, with more brownish pollen. Hairs and bristles of the dorsum black; acrostical hairs obsolete before the scutellum; dorso-central bristles only developed behind the wing-base, longer behind but nevertheless short and weak. Humeri with yellowish hairs and three short black bristles in front. Sternopleura with some fine yellow hair above. Scutellum reddish, golden pollinose on the flat upper surface; two black apical bristles.

Legs rusty reddish yellow; posterior tibiae ferruginous except the under side; posterior tarsi ferruginous except the first

segment; apical two segments of the anterior four tarsi and the immediate apices of the preceding segments and of the tibiae, ferruginous. Anterior basitarsus with a patch of strong, almost parallel-sided "tubercles" basally and without bristles beneath.

Wings strongly tinged with luteous, the broad apical and posterior border darker. Halteres reddish.

First abdominal segment brown with narrow grey pollinose apex, the sides rusty reddish; base of second segment reddish except in the middle, apical half gray, the intermediate portion opaque black. Third and fourth segments chiefly gray, the opaque black base widened in the middle; apices of second and third segments narrowly yellow. Fifth to seventh segments opaque brownish black, with black hair. Sides of first four segments clothed with brownish pollen and yellowish to reddish hair, the hair elsewhere black. Genitalia ferruginous.

Female. Eighth abdominal segment opaque brownish black with the margin shining; ovipositor with five fairly strong spines on either side.

Holotype, ♂, *allotype,* ♀; Bartica, British Guiana, May 17, 1901, (R. J. Crew), Type no. 6359, in the Academy of Natural Sciences, Philadelphia, Pa.

Paratypes: ♂, Bartica, May 21, 1901; ♂, Bartica, May 22, 1901, (Crew); ♀, Kartabo, Bartica District, British Guiana, 1921; ♀, Kartabo, New York Zoological Society no. 20805.

Mallophora pulchella new species

Allied to *M. robusta* Wiedemann, but the posterior legs are wholly black pilose in the female, the beard whitish instead of yellow and the anterior coxae are entirely black haired.

Length, 16 to 18 mm. *Male.* Antennae rusty reddish, the third segment black, one-third longer than the two basal segments combined, the style a little longer than the third segment, its basal section two-thirds as long as the apical portion. Face shining black, the orbits narrowly gray pollinose; finer hairs of the mystax pale yellow, those below and a few above, black; hairs of the face and front pale yellow, the frontal orbits with black bristles. Occiput gray pollinose and clothed with black hair except the posterior orbits and the broad orbits of the cheeks which bear pallidly yellowish hair. Palpi castaneous; black haired.

Thorax opaque black; pleura densely velvety brown pollinose from most views; humeri and posterior calli castaneous. Pile black, at most a few yellowish hairs in a band between the humeri. Scutellum entirely black haired.

Legs castaneous or brownish ferruginous, black haired, the posterior femora white haired except at the base; posterior tibiae with long, snow-white hair except on the basal three-fourths of the upper surface, which is clothed with long black hair, but on the broad base the hair is short.

Wings yellowish brown. Squamae brown, with brown fringe. Halteres reddish.

Abdomen densely pilose, the first segment and a triangle on the second, black haired, bordered with yellow behind, the following segments with orange-colored pile, the apex of the abdomen with paler hair. Genital style projecting half its length beyond the forceps. Apical half of the venter yellow pilose, the basal portion with black hair.

Female. Pale hair of the posterior orbits more yellowish, not extending to the middle of the cheeks so that the beard is almost all black; yellow hairs on the mesonotum forming a distinct band between the humeri. Legs entirely clothed with black hair.

Holotype, ♂, *allotype*, ♀; Cauca, Colombia, (Fortunato Bonis), Type no. 6360, in the Academy of Natural Sciences, Philadelphia, Pa.

Tachinidae

Leskia pellucens new species

Length, 10.5 mm. *Male.* Head yellowish, the upper three-fifths of the occiput black except behind the vertex, silvery white pollinose; the pollen on the upper half of the front yellow, silvery on the black portion of the occiput except along the orbits. Front about three-fifths as wide as greatest width of eye, the orange frontal vitta as wide as a parafrontal; frontal bristles descending to the base of the second antennal segment; a single row of inconspicuous yellow hairs outside the frontals. Vertical bristles decussate. Proboscis rusty yellow; palpi yellow, longer than antenna, moderately stout, enlarged and slightly upturned on the apical fourth. Cheeks with yellow hairs and three black bristles, their width hardly equal to one third the eye-height. Antennae reddish yellow, the third segment brownish on the apical half, a little more than twice as long as the second segment; arista brown, plumose, the longest rays shorter than the width of the third antennal segment.

Mesonotum black, the sides and scutellum yellow, the whole densely ochreous pollinose; pleura whitish pollinose, largely yellow in ground color, the hypopleura, metathorax and pectus chiefly black. Hair of the notum black, of the sides and pleura, yellow. Three posterior dorso-centrals; only prescutellar acrosticals; three sternopleurals. Apical scutellars absent.

Legs reddish yellow, the tarsi black, the posterior tibiae rusty brown.

Wings yellowish, apically and posteriorly, infuscated, darker about the veins; first vein with strong bristles on the basal fifth, the third bristly three-fourths the distance to the small cross-vein. Squamae and halteres yellow.

Abdomen rusty yellow, more reddish apically, the second and third segments each with a small apical black triangle and lateral spot, the fourth without the median triangle but with the lateral spots. Second segment without marginal bristles, the third segment with a pair of median marginals and four on either side, the fourth with a preapical row of bristles and the margin with a row of long bristly hairs.

Holotype, ♂; Corocito, Honduras, April 3, 1924, (J. Bequaert), in Curran Collection.

Scotiptera robusta new species

Differs from *S. melaleuca* Wiedemann in its greater size, more robust form, absence of white spots on abdomen, more evident and broader bare vittae on the mesonotum, etc. Front of male, ⅛, of female, ¼ head width.

Length, 18 mm. *Male* and *female*. Width of cheeks equal to half the eye-height. Head argenteous-gray pollinose, the upper fifth of the parafrontals and the frontal vitta black or brownish black, the vitta four or five times as wide anteriorly as at ocelli. Twelve to fifteen pairs of fine, cruciate frontal bristles, the lowest situated just below the base of the antennae; ♀ with three pairs of orbital bristles. Ocellar bristles weak but conspicuous; vertical bristles cruciate, fairly strong; outer verticals divergent. Hairs of the head black; only two irregular rows lying outside the frontal bristles; hair below the neck whitish, but this is not readily seen as the black hairs extend well onto the back of the head. Cheeks bare on more than the upper half. Facial carina very strong; parafacials hardly half as wide as median depression; oral vibrissae approximated. Palpi black and bearing black hair. Antennae brown, the first two segments usually brownish yellow; third segment only half as wide as the second, three times as long, the antennae reaching to the lower third of the face; second antennal segment with numerous hairs and one long, outstanding bristle situated at the middle above. Arista with long hairs on the whole surface, brown in color with the swollen basal fifth luteous.

Thorax dirty brownish yellow; pleura gray pollinose; mesonotum with a pale pollinose vitta on the dorso-central line which tapers posteriorly, becoming obsolete at the posterior fourth;

humeri also gray pollinose. Inside the pollinose vitta is a wholly bare vitta which is narrow and extends from the anterior margin to a little behind the suture, while there is a similar bare vitta outside the pollinose one, this being wide in front, tapering to the posterior end, rising at the anterior fourth and extending to the posterior fifth, but interrupted at the suture. The median line of the mesonotum is also slightly paler in front and there are five very distinct, narrow, chocolate colored vittae. One weak pair of anterior acrosticals; only the prescutellar acrosticals strong behind the suture; three weak anterior dorso-centrals and five or six posterior, with only the two posterior pair strong; two intra-alar bristles and two adventitious bristles between the supra-alars; sternopleurals 2:1. Scutellum rather ferruginous, clothed with ochreous-brown pollen; four pairs of marginal bristles, the apical pair cruciate and hardly as strong as the subapical pair.

Legs normally black; basal half of the femora rarely reddish; posterior tibiae obscurely reddish in the middle. Wings blackish brown, paler apically. Squamae brown, with long, brown fringe. Halteres brown.

Abdomen opaque blackish brown, the venter dull reddish with black segmental apices; bases of each segment (varying from one-fourth to two-fifths) dull brick reddish, except on the median line, and densely clothed with ochreous or almost golden pollen, best seen from in front, in other views almost wholly covered; elsewhere with cinnamon-ochreous pollen. Hair of the abdomen wholly black; bristles quite robust, the first segment with one or two pairs of marginals, the second with two to six pairs of discals and a laterally interrupted row of marginals, the two following segments with discals covering almost all the dorsum in more or less regular rows. Male genitalia placed well forward, the posterior forceps three times as long as wide, the apical half narrow and split, its sides parallel.

Holotype, ♂; Hacienda Vista Nieve, near Hacienda Cincinnati, Sierra San Lorenzo, Magdalena, Colombia, Dec. 16, 1922, (H. L. Viereck); in Curran Collection.

Allotype, ♀; same locality, Dec. 20, 1922, (Viereck).

Paratypes: 4 ♂, same locality, Dec. 18, 1922, (Viereck); ♂, Hacienda Cincinnati, Sierra San Lorenzo, Magdalena, Colombia, on trail to Vista Nieve, 4500 to 4700 ft., July 21, 1920, (Rehn and Hebard). Paratypes are in the Academy of Natural Sciences, Philadelphia, and the collection of C. W. Johnson.

This species agrees in general with the genotype, *melaleuca* Wiedemann, of which there are four specimens before me.

The whitish abdominal spots in these specimens are larger than indicated in Macquart's figure.[1] Wiedemann described *Dexia melaleuca* from Rio Janeiro. My specimens are from Brazil and British Guiana.

In the genus *Scotiptera* the prosternum is bare, there are no spinules beneath the squamae and the median portion of the propleura lacks hairs; there is at most a single pair of anterior acrostical bristles, while the posterior acrosticals are represented by a pair of fairly strong prescutellars and sometimes one or two very weak pairs. The genotype lacks presutural acrostical bristles.

[1] Dipt. Exot., II, (3), plate IX, figure 9.

DERMAPTERA AND ORTHOPTERA FROM THE STATE OF SINALOA, MEXICO.

BY MORGAN HEBARD

Part II

Saltatorial Orthoptera

The first portion of this study was published in 1923. Since that time no additional material has been received from Sinaloa, the present report being, in consequence, likewise almost wholly based on material secured by Mr. J. A. Kusche, while collecting general entomological material in 1916 and 1918. The representation from Venvidio is particularly good, but it is naturally not as complete as would be the case had a resident been able to continue the work, or had collecting of Orthoptera been exclusively undertaken. We have good reasons for believing that a richer and more abundant Orthopteran fauna will be found inland in the state of Sinaloa, at higher elevations in the foothills of the Sierra Madre.

In the present paper eleven hundred and fifty-six specimens are recorded, representing forty-four genera and sixty species, of which two genera and five species were previously undescribed.

The whole collection we have reported from Sinaloa thus contains a total of eighteen hundred and sixteen specimens, including seventy-three genera and ninety-seven species.[1] A total of three genera and sixteen species were previously undescribed.

The distribution of the species here recorded, or of their nearest affinities, is noted in the following table.

ACRIDIDAE

ACRYDIINAE

Paratettix aztecus aztecus (Saussure)	Northward and southward.
Paratettix toltecus Saussure	Northward and southward.

[1] Of these seven are carried by commerce and not to be considered as of the native fauna.

ACRIDINAE

**Machaerocera mexicana* Saussure	Eastward and southward to Nicaragua.
Amblytropidia mysteca (Saussure)	Mexico, northwestern recorded limit.
Dichromorpha longipennis Bruner	Sinaloa to Jalisco.
Dichromorpha mexicana Bruner	Sinaloa to Jalisco.
Morseiella flaviventris (Bruner)	Sinaloa and Tepic, related species northward.
Scyllina viatoria viatoria (Saussure)	Central-southern Arizona to uplands of Costa Rica.

OEDIPODINAE

Encoptolophus subgracilis Caudell	South Dakota to Durango and Jalisco.
Lactista oslari Caudell	South-central Arizona to Sinaloa.
Tomonotus ferruginosus Bruner	Southwestern United States to Sinaloa.
Heliastus benjamini Caudell	Southern Arizona to Sinaloa.
**Heliastus sumichrasti* (Saussure)	Widely distributed in Mexico northwestward to Sinaloa.

BATRACHOTETRIGINAE

Brachystola behrensii Scudder	Sinaloa, related species northward.

CYRTACANTHACRINAE

**Chromacris colorata* (Serville)	Widely distributed in tropical Mexico, northwestward to Sinaloa.
Leptysma mexicana (Saussure)	Mexico, northward to Vera Cruz and San José del Cabo, Baja California.
**Opshomala marshalli* (Bruner)	Costa Rica northward through Mexico to Sinaloa.
**Proctolabus cerciatus* new species	Related species in arid subtropical Mexico only.
**Abracris obliqua* (Thunberg)	Very widely distributed through the tropical Americas, northwestward to Sinaloa.
**Osmilia flavo-lineata* (DeGeer)	Very widely distributed through the tropics of northern South and North America, northwestward to Sinaloa.
**Schistocerca camerata* Scudder	Sinaloa, related species southward.
Schistocerca vaga vaga Scudder	Southwestern United States to Nicaragua.
**Schistocerca pallens* (Thunberg)	South America northward to West Indies and Sinaloa.
Schistocerca americana americana (Drury)	Southern Ontario through United States and Bahamas, in Mexico to Morelos and Jalisco.

Sinaloa behrensii Scudder	Sinaloa.
Sinaloa pulchella new species	Sinaloa.
Conalcaea poecila new species	Related species northward.
**Aidemona azteca* (Saussure)	Sinaloa, south to Cali, Colombia.
Melanoplus complanatipes Scudder	Southwestern United States to Sinaloa.

TETTIGONIIDAE

PHANEROPTERINAE

Insara abbreviata (Brunner)	Sinaloa and Morelos.
**Insara sinaloae* new species	Related species southward.
**Phaneroptera paronae* (Griffini)	Sinaloa, southward to Panama.
**Stilpnochlora thoracica* (Serville)	Sinaloa, southward to Costa Rica.
**Montezumina oblongoculata* (Brunner)	Sinaloa, southward to Costa Rica.
**Montezumina sinaloae* new species	Related species southward.
Microcentrum rhombifolium (Saussure)	Probably southwestern limit, widespread in United States eastward.
Microcentrum suave Hebard	Sonora to Tepic.

PSEUDOPHYLLINAE

**Gongrocnemis pallidespinosa* Brunner	Sinaloa, south to Guatemala.

COPIPHORINAE

**Caulopsis cuspidata* (Scudder)	Cuba and Sinaloa, southward to Nicaragua.
Neoconocephalus triops (Linnaeus)	Eastern and southwestern United States, south to Ecuador.

CONOCEPHALINAE

Orchelimum unispina (Saussure and Pictet)	Baja California and Sonora to Jalisco and Orziaba, Vera Cruz, Mexico.
**Conocephalus cinereus* Thunberg	Sinaloa and West Indies, widely distributed southward through the tropical Americas.
Conocephalus ictus (Scudder)	Baja California and Vera Cruz, southward to Nicaragua.

DECTICINAE

Rehnia sinaloae Rehn and Hebard	Related species northward.

GRYLLIDAE

TRIDACTYLINAE

Tridactylus apicialis Say	Canada to Argentina.
Ellipes minuta (Scudder)	Canada to Argentina.

MOGOPLISTINAE

Cycloptilum hesperum (Rehn and Hebard)	Baja California and Sinaloa.
Cycloptilum robustum new species	Sinaloa.

NEMOBIINAE

Nemobius cubensis mormonius Scudder	Southwestern United States to Vera Cruz and Tabasco.
Nemobius carolinus neomexicanus Scudder	Southwestern United States to Costa Rica.

GRYLLINAE

Gryllodes sigillatus (Walker)	Circumtropical and subtropical North America.
Miogryllus verticalis (Serville)	New York to Argentina.
Gryllus assimilis (Fabricius)	North and South America.

OECANTHINAE

Oecanthus niveus (DeGeer)	United States, south to Guatemala.
**Oecanthus varicornis* Walker	Sinaloa, south to northern Panama.
Oecanthus nigricornis Walker	United States, south to Durango and Sinaloa.

TRIGONIDIINAE

**Cyrtoxipha gundlachi* Saussure	Florida, Cuba, Jamaica and Sinaloa, south to Panama.
**Anaxipha tolteca* (Saussure)	Sinaloa, south to Panama.

ENEOPTERINAE

**Paroecanthus aztecus* Saussure	Mexico, northwestward to Sinaloa.
**Paroecanthus mexicanus* Saussure	Tamaulipas and Sinaloa to Tabasco.

This and the list previously published shows that forty-two of the ninety-seven species are tropical forms reaching their northern limit in Sinaloa on the west coast of Mexico. Such forms are indicated by an asterisk and make a total of nearly half those reported, while but twelve are previously known only from north of Sinaloa or are related to species there found. Twenty species are known only from this region, seven others being recorded only from Baja California and Sonora to Morelos. Thus nearly four times as many species have reached Sinaloa from the south than from the north. Over thirty per cent of the Orthopteran fauna is known only from the tropical or subtropical and largely arid coastal region, extending from lower

Baja California and Sonora to Jalisco. The genus *Sinaloa* is the most distinctive development of this native fauna.

The material here recorded, unless otherwise stated, is in the author's collection.

Acrididae

acrydiinae

Paratettix aztecus aztecus[2] (Saussure)

1861. *T[ettix] azteca* Saussure, Rev. et Mag. de Zool., (2), xiii, p. 400. [♂, ♀; "Mexico calida."]

Venvidio, VII, 6 to 12, 1918, 1 ♀.

This individual agrees closely with females from Guerrero, Mexico, paratypes of the synonymous *parviverticis*.

The race is widely distributed in Mexico, and is now known from the southwestern United States to Panama, though northward on the Pacific Coast supplanted by *P. aztecus hesperus* Morse. After consideration of very large series of the latter we are convinced of its racial status, its known range extending from the state of Washington to the Distrito Sur, Baja California.

Paratettix toltecus (Saussure)

1861. *T[ettix] tolteca* Saussure, Rev. et Mag. de Zool., (2), xiii, p. 401. [♂, ♀; "Mexico calida."]

Villa Union, IX, 27, 1918, 1 ♀. Rosario, 2 ♀.

The first specimen is very large and robust, as are a male and six females in the author's collection, from San José del Cabo, Baja California. The others are of the more usual, smaller, size.

This species is likewise widely distributed through Mexico and occurs from the southern United States to Panama. It is the insect which we were greatly surprised to find in extreme southern peninsular Florida. We had, before that time, supposed it to be limited to the semi-arid southwest in the United States.

[2] We have recently placed *Telmatettix* Hancock as a synonym of *Paratettix*, and *T. parviverticis* Hancock as a synonym of *aztecus*. Trans. Amer. Ent. Soc., l, p. 86, (1924).

ACRIDINAE

Machaerocera mexicana Saussure

1859. *M[achaerocera] mexicana* Saussure, Rev. et Mag. de Zool., (2), XI, p. 391. [♂, ♀; "Mexico calida."]

1870. *Oxycoryphus tibialis* Walker, Cat. Dermapt. Saltat. British Mus., IV, p. 787. [♂, ♀; Oaxaca, Mexico.]

1874. *Machaerocera sumichrasti* Thomas, Bull. U. S. Geol. Surv. Terr., I, 1st Ser., no. 2, p. 70. [♀, Mexico.]

1904. *Machaerocera obscura* Bruner, Biol. Cent.-Amer., Orth., II, p. 50. [♂, ♀; Rio Papagaio, Tierra Colorado and Rincon, Guerrero, Mexico; Rio Sarstoon, British Honduras; San Geronimo, Guatemala.]

1904. *Machaerocera pacifica* Bruner, ibid., p. 51. [♂, ♀; Tepic, not far from San Blas, Mexico.]

A series of one hundred and sixty-three specimens from all parts of the known distribution of *mexicana* enables us to indicate the above synonymy. In 1902, after a study of thirty-two specimens from the states of Vera Cruz and Morelos, Rehn stated, "I have reached the conclusion that *sumichrasti* of Thomas is nothing but a phase of this very variable species."[3] Not only does the present material bear out that conclusion, but the possession of the type[4] and paratypes of Bruner's *pacifica* and numerous cotypes of his *obscura* further shows the synonymy of those names. Last year Uvarov pointed out the fact that *sumichrasti* was the same as Walker's *tibialis*. Study of the type of *M. magna*, Bruner,[5] in the British Museum, from Durango or Sinaloa, Mexico, leaves us uncertain as to whether it is an exceptionally large and broad female of *mexicana* or represents a distinct species.

It is evident that Bruner noted certain color differences and, without examination of series, assumed that they had specific significance. As would be expected, the insect in certain regions shows some size variation. Tamaulipan individuals at hand are slightly more slender than is usual, while the Vera Cruz series,

[3] Trans. Amer. Ent. Soc., XXIX, p. 9.

[4] Selected by Rehn and Hebard, Proc. Acad. Nat. Sci. Phila., 1912, p. 110; Hebard Collection, no. 237.

[5] Mr. B. Uvarov has kindly done this work and writes, "fastigium of vertex broadly triangular (instead of narrow). Frontal ridge (costa) in profile very obtuse-angulate inflexed, the angle rounded (instead of obtuse-angulate inflexed). Length of body 42.5, length of pronotum 10.5, length of tegmen 39, length of caudal femur 24 mm."

the majority from a considerable altitude in the mountains, averages small. These features are by no means sufficiently marked or constant to warrant even racial recognition. The wing coloration in the proximal two-fifths varies (slightly) from light sky blue to yale blue,[6] the remaining portions of the wings distad being heavily suffused with fuscous. In pale (recessively colored) individuals this suffusion is solid only distad, the remaining portions of the distal three-fifths of the wings being fuscous only about and including the veins and veinlets.[7] The vertex is seen to be more elongate with lateral carinae more raised in some specimens than in others. This is plainly a matter of individual variation. The bluish area of the caudal tibiae (from the brief distal suffusion to the broad proximal annuli) is confined to its ventral and lateral faces.[8]

Rehn recorded[9] material from Guadalajara, Jalisco, as *pacifica*, considering the antennae to be heavier and the caudal femora more slender than in *mexicana*. Some variation in these features occurs, but none warranting nominal recognition of any kind.

Villa Union, IX, 27, 1918, 2 ♂, 1 ♀, 1 juv. ♀.

These adults are large and robust for the species, with distal portions of the wings solidly suffused. They agree closely with a series before us from Tepic. This is the northwestern-most record for the species, elsewhere known from Altamira, Tamaulipas, southward to British Honduras and San Geronimo, Nicaragua. North of Guadalajara, Jalisco, and Cuernavaca, Morelos, it has not been found anywhere in central Mexico.

Amblytropidia mysteca (Saussure)

1861. *Stenobothrus* [*Rhammatocerus*] *mystecus* Saussure, Rev. et Mag. de Zool., (2), XIII, p. 317. [Mexico.]

1896. *Amblytropidia auriventris* McNeill, Proc. Davenport Acad. Nat. Sci., VI, p. 227. [Orizaba, [Vera Cruz,] Mexico.[10]]

1904. *Amblytropidia ingenita* Bruner, Biol. Cent.-Amer., Orth., II, p. 67. [♂, ♀; Orizaba, [Vera Cruz]; Chilpancingo, Guerrero, and Cuernavaca, Morelos, Mexico.]

[6] The blue is destroyed in individuals which apparently were immersed in alcohol.

[7] This constituted one of Bruner's major reasons for separating what he considered *sumichrasti* and *magna*, though in the series labelled *sumichrasti* by him, all show the more usual solid wing suffusion.

[8] This color is likewise destroyed by immersion in, apparently, alcohol.

[9] Proc. Acad. Nat. Sci. Phila., 1904, p. 517, (1904).

[10] The male single type is here selected, Hebard Collection, no. 242. It was secured at Orizaba, in November, 1887, by L. Bruner.

Rehn, in 1902,[11] established the synonymy of *auriventris*, but that name was resurrected by Bruner in 1904 for material before him from Atoyac and Orizaba. Though the Atoyac series clearly belongs to a distinct species, the specimen from Orizaba (the original type locality) represents *mysteca*.

Rosario, 6 ♂, 5 ♀, 4 juv. Venvidio, VI, 30 to VII, 31, 1918, 1 ♂, 1 ♀. Los Mochis, XII, 29, 1917, 1 ♂.

The lateral carinae of the pronotum are parallel in the majority of this series, very feeble divergence caudad being indicated in a few specimens. In most of the females and a few males from the state of Vera Cruz these carinae show weak divergence caudad. This was one of the most important characters used by Bruner in separating his *ingenita*. So slight is this difference that we do not consider the western insect worthy even of racial recognition. Our position is strengthened by consideration of large series of the closely allied *A. occidentalis* Saussure from the southeastern United States, in which the lateral carinae of the pronotum vary individually from parallel to faintly convex to weakly divergent caudad to different degrees.

Dichromorpha longipennis Bruner

1904. *Dichromorpha longipennis* Bruner, Biol. Cent.-Amer., Orth., II, p. 87. [♂, ♀; Tepic, Mexico.]

Rosario, 7 ♂, 8 ♀. Mazatlan, II, 21, 1918, 10 ♂, 7 ♀. Venvidio, VIII, 8 to 29, 1918, 2 ♂, 4 ♀. Los Mochis, XII, 7, 1917 to I, 2, 1918, 69 ♂, 29 ♀, 10 juv.

The fine series shows that this little-known species is abundant in Sinaloa. It is a remarkable insect, apparently best referred to *Dichromorpha* Morse, but clearly diverging strongly toward *Parachloebata* Bruner, a genus showing nearest affinity to *Orphulella* Giglio-Tos. Its coloration and form are Orphulelloid, but the strong and parallel lateral carinae of the pronotum oblige assignment to *Dichromorpha*.

Several color phases occur; the males are all brown, or brown with dorsum green; the females all brown, or all green, or brown with lateral portions green.

Confusion with *Orphula azteca* (Saussure) might occur, as these species are superficially quite similar. The male of the latter has a striking fenestrate area of the wings, and when

[11] Trans. Amer. Ent. Soc., XXIX, p. 9.

not spread the apices of the tegmina and folded wings are conspicuously broader.

A single male from Guadalajara, Jalisco, is in the Academy collection, the species otherwise being known only from the original series, belonging to the author, which has been dried after immersion in alcohol, and the present material.

Dichromorpha mexicana Bruner

1904. *Dichromorpha mexicana* Bruner, Biol. Cent.-Amer., Orth., II, p. 87, pl. I, figs. 18 and 18a. [♂, ♀; Sinaloa and Tepic, Mexico.]

Villa Union, IX, 27, 1918, 1 ♂.

This is a handsome insect which is closely related to *D. viridis* (Scudder), the latter a species widely distributed over the eastern half of the United States. The Mexican species may be distinguished by the more robust form, broader vertex, fully developed organs of flight and other more subtle characters. The tegmina and wings are normally much reduced in *viridis*, though a very few macropterous females of that species are before us.

A large series from Guadalajara, Jalisco, represents this species, which was recorded as atypical *viridis* by Rehn in 1904.[12] That series has the females all brown or all green; the males dark brown laterad, but with dorsum paler brown or green. The type and paratypes from Tepic are discolored from immersion in alcohol. The present male is brown, with dorsum greenish and genicular areas of the caudal femora not strikingly darkened, though such is true of the males from Guadalajara.

The species has not been reported from other than the localities noted above.

MORSEIELLA[13] new genus

The genus is erected to include two species, described and referred by Bruner to *Boopedon* Thomas. These are *diabolica* and *flaviventris*, the single types of both, from Tepic, Mexico, being in the author's collection. Of these we select *flaviventris* as genotype of *Morseiella*.

This genus agrees with *Boopedon* in the following characters. Size large. Head large in proportion to body bulk. Fastigium

[12] Proc. Acad. Nat. Sci. Phila., 1904, p. 518.

[13] This interesting new genus is named in honor of our friend, Professor Albert P. Morse, whose masterly contributions have aided so greatly toward reaching a better understanding of the North American Orthoptera.

rounding rather broadly into frontal costa. Lateral foveolae of vertex visible from above, forming an obtuse angle with the plane of the fastigium. Face only moderately oblique. Antennae filiform, cylindrical, flattened but not widened proximad. Median carina of pronotum as decided on prozona as on metazona, cut only by principal sulcus. Prosternum simple. Tegmina well developed or reduced to different degrees, in most species showing greater reduction in the female sex. Caudal femora large and heavy. Internal spurs of caudal tibiae much longer than the external, the ventral considerably longer than the dorsal.

These genera may be distinguished as follows:

A. Fastigium with lateral carinae and lateral foveolae subobsolete to weakly indicated. Fastigio-facial angle broadly rounded.[14] Eyes very broad. Male tegmina normal, fully developed to greatly reduced, always with marginal field narrowing strongly distad, humeral and discoidal veins diverging very feebly distad. Female tegmina normal, but greatly reduced or represented by lanceolate pads . . . *Boopedon* Thomas

AA. Fastigium with lateral carinae and lateral foveolae well indicated. Fastigio-facial angle less broadly rounded. Eye broad. Male tegmina reduced, with marginal field not narrowed distad, humeral and discoidal veins diverging considerably distad. Female tegmina represented by ovate or subacuminate pads . . . . . *Morseiella* new genus

The more robust form, larger head, less caudate organs of flight, much shorter ventro-internal spur of the caudal tibiae and very different types of color pattern readily distinguish these genera from *Scyllina* Stål.

Morseiella flaviventris (Bruner)

1904. *Boopedon flaviventris* Bruner, Biol. Cent.-Amer., Orth., II, p. 98. [♂, ♀; Tepic[15] and Durango or Sinaloa, Mexico.]

Venvidio, VI to IX, 2, 1918, 21 ♂, 16 ♀, 3 juv.

The brilliant coloration of this handsome insect shows only moderate variation in the present series. With recession the dark markings become less extensive and with intensification they spread out, particularly dorso-mesad on the pronotal lateral lobes. The decided annuli of the caudal tibiae are

[14] Differing slightly in degree in different species.

[15] The larger of the two males from this locality has been selected as single type, Hebard Collection, no. 260, by Rehn and Hebard, Proc. Acad. Nat. Sci. Phila., 1912, p. 112, (1912).

present in all and usually very conspicuous. These members are blackish brown proximad, followed by a broad annulus of yellowish buff and an equally broad annulus of blackish brown which becomes weak distad, fading into the pink of the distal two-fifths.

The male tegmina overlap and show flattening dorsad and laterad, with broad apices truncate but broadly convex. The female tegmina are much more simple, represented by broad oval pads, which weakly overlap and distad vary from evenly rounded to very broadly acuminate.

Considerable size variation is shown by the following measurements (in millimeters), the extremes of the present series being given.

♂	Length of body	Length of pronotum	Greatest caudal width of pronotal disk	Length of tegmen	Length of caudal femur
Venvidio,.....	23.3	5.6	3.3	11.5	17.1
Venvidio,.....	21.2	4.8	3	9.5	15
Tepic, *type*.....	21	4.8	2.9	9	14.7
Tepic, *paratype*.....	18.4	4	2.7	8.4	13.5
♀					
Venvidio,.....	31.5	7.2	5.4	7.1	22.7
Venvidio,.....	37	7.7	5.9	7.6	23.3

The species is known only from the material before us.

Scyllina viatoria viatoria (Saussure)

1861. *St[enobothrus] viatorius* Saussure, Rev. et Mag. de Zool., (2), XIII, p. 317. [All of Mexico.]

Villa Union, IX, 27, 1918, 2 juv. ♀. Rosario, 19 ♂, 29 ♀. Venvidio, VI, 24 to VII, 12, 1918, 2 ♂, 3 ♀. Los Mochis, XII, 28 and 29, 1917, 2 ♂, 3 ♀.

These individuals are all large and richly colored. The species is generally distributed in Mexico except at high elevations, and is known from central-southern Arizona southward to Honduras and Nicaragua and into the uplands of Costa Rica.[16]

OEDIPODINAE

Encoptolophus subgracilis Caudell

1903. *Encoptolophus subgracilis* Caudell, Proc. Ent. Soc. Washington, V, p. 163. [♂, ♀; Phoenix, Arizona.]

[16] See Hebard, Trans. Amer. Ent. Soc., L, pp. 157 to 162, pl. IX, (1924).

1905. *Encoptolophus texensis* Bruner, Biol. Cent.-Amer., Orth., II, p. 142. [♂, ♀ : Southern California; El Paso and Carrizo Springs,[17] Texas; Mesilla, New Mexico; Queretero and Lerdo, Durango, Mexico.]

Careful study of large series, including the type of *texensis*, offers conclusive evidence of the above synonymy. The series from Arizona and Sinaloa appeared to have a slightly narrower vertex, slightly heavier caudal femora and slightly shorter organs of flight than those from New Mexico and Texas. Individual examination, however, proves that such differences as were noted can be found between specimens in each large series taken at the same locality. A matter of similar individual variation is the wing coloration, ranging from clear hyaline to a condition in which these organs are tinged with yellow proximad and suffused with brown distad.

Further study of material from the coast of southern California may show *E. robustus* Rehn and Hebard to be another synonym, but from the material now available it appears more probable that it represents a geographic race of *subgracilis*.

Los Mochis, XII, 4 to 21, 1917, 15 ♂, 5 ♀, 2 very small juv.
Villa Union, II, 21, 1918, 1 ♀.

The considerable size variation in the present series is shown by the measurements (in millimeters) of the extremes, given below.

♂	Length of body	Length of pronotum	Caudal width of pronotal disk	Length of tegmen	Length of caudal femur
Los Mochis,.....	15.2	3	2.4	13.8	9
Los Mochis,.....	19.7	4.2	2.9	18.4	11.8
♀					
Los Mochis,.....	22.3	4.8	3.2	18.1	11.7
Los Mochis,.....	26.5	5.7	4.2	24	14.7

The known distribution of this insect, as here recognized, extends from the southwestern United States northeastward as far as Capa, South Dakota.[18] Southward in Mexico it is known as far as Lerdo,[19] Durango and Zapotlanejo[20] and Juanacatlan,[20] Jalisco.

[17] A male from this locality has been selected as single type; Hebard Collection, Type no. 49.

[18] See Hebard, Proc. Acad. Nat. Sci. Phila., LXXVII, p. 73, (1925).

[19] Recorded by Bruner as *texensis* in 1905.

[20] Recorded by Rehn as *costalis* in 1904.

Lactista oslari Caudell

1905. *Lactista oslari* Caudell, Proc. U. S. Nat. Mus., XXVIII, p. 468. [♂; Nogales, Arizona.]

Rosario, 4 ♂, 11 ♀. Mazatlan, II, 21, 1918 and XII, 16 to 31, 1916, 15 ♂, 7 ♀, 1 juv. Los Mochis, XII, 2, 1917 to I, 2, 1918, 12 ♂, 6 ♀. Villa Union, IX, 27, 1918, 3 ♂, 2 ♀, 2 juv. Venvidio, VI, 16 to IX, 2, 1918, 8 ♂, 5 ♀, 3 juv.

It is interesting to note that, whereas this species is evidently common and generally distributed in coastal Sinaloa, the species of similar abundance and wide distribution in Baja California is *L. gibbosus* Saussure.[21]

The species is decidedly plastic, considerable variation being found in form and width of fastigium, pronotal crest, ventrocaudal angle of pronotal lateral lobes and color of caudal tibiae. The present series differs from Arizona material before us, in having the fastigium usually broader with lateral carinae more curved and the distal portions of the caudal tibiae buffy or faintly glaucous, instead of rich glaucous. In addition, some are more elongate, with longer caudal femora, lower pronotal crest and angulation of pronotal metazona more acute, than others. All of these features are seen to be wholly a matter of individual variation, though at first it might easily be supposed that at least geographical racial separation was necessary.

The extremes of the present series measure (in millimeters) as follows:

♂	Length of body	Length of pronotum	Caudal width of pronotal disk	Length of tegmen	Length of caudal femur
Mazatlan,.....	14.7	3.5	2.1	17	9
Venvidio,.....	17	4.6	3.1	20.3	11.8
♀					
Rosario,.....	22	5	3.8	23	12.7
Venvidio,.....	24.3	5.8	4	26.8	14.8

This handsome insect, which is easily distinguished from its nearest ally, *gibbosus*, is known only from extreme south-central Arizona and the localities here noted.

[21] Rehn's record of *gibbosus* from Mazatlan, in 1902, repeated by Bruner in 1905, was based on a pair of *oslari*, dried after immersion in alcohol.

Tomonotus ferruginosus Bruner

1905. *Tomonotus ferruginosus* Bruner in Caudell, Proc. U. S. Nat. Mus., XXVIII, p. 470, fig. 4. [♂, ♀: Fort Grant, Santa Rita Mountains, Phoenix and Huachuca Mountains, Arizona; California.]

Rosario, 1 juv. Los Mochis, XII, 29, 1917, 1 ♂. Venvidio, VI, 24 to VII, 12, 1918, 2 ♂.

The adults show a distinct color pattern of darker brown and the disk of the wings is bittersweet orange.

The species is known from "California"; southern Arizona; San Pedro Bay, Sonora, and the localities given above.

Though subject to considerable individual variation and closely related to *T. mexicanus* Saussure, we believe that it represents a distinct species. Larger series are needed, however, before its specific validity can be determined with certainty.

Heliastus benjamini Caudell

1905. *Heliastus benjamini* Caudell, Proc. U. S. Nat. Mus., XXVIII, p. 474, fig. 6. [♂, ♀; Huachuca Mountains, Arizona.]

Rosario, 1 ♀.

This individual agrees closely with material from Arizona, except that it is distinctly more slender than the great majority of females from that state. The few Mexican specimens recorded by Rehn as *H. aztecus* Saussure show very little difference from *benjamini* except in the more generally suffused coloration, with the bands of the tegmina and caudal femora indistinct (as described for that insect). Considering the great amount of variation known to occur in the species of the genus, it would seem very possible that *benjamini* deserves not more than racial recognition at best. So constant are the general differences of coloration in the series from the United States, however, that such action must be deferred until more Mexican material can be examined and general revision of the genus undertaken.

This insect has been previously reported only from the mountains of southern Arizona.

Heliastus sumichrasti (Saussure)

1861. *Oe[dipoda] sumichrasti* Saussure, Rev. et Mag. de Zool., (2), XIII, p. 324. ["Mexico calida."]

1900. *Lactista inermis* Rehn, Trans. Amer. Ent. Soc., XXVII, p. 96. [♂; Cuernavaca, Morelos, Mexico.]

The type of *Lactista inermis* Rehn, belonging to the Academy, is in no way separable from other material, received since 1900,

determined as *sumichrasti* by Saussure and which is apparently typical. Generic confusion was undoubtedly largely responsible for this synonym, indicated as such by Rehn in 1901.

Rosario, (on river bed on sand), 5 ♂, 11 ♀, 1 juv. Mazatlan, (Eisen and Vaslit), 3 ♂, 2 ♀. Venvidio, VIII, 18 and IX, 2, 1918, 3 ♀, 1 juv.

All but one of this series are heavily tessellate with darker brown. The disk of the wings ranges from buff-yellow to light salmon orange, the wing band being absent or indicated caudad as a very broad but very weak suffusion.

Material from Guadalajara, Jalisco, agrees closely, except that the wing disk varies from light salmon-orange to grenadine. Though the facies is slightly different, we do not believe that more than incipient racial differentiation is indicated. Other material from Tamaulipas, Vera Cruz, Morelos and Guerrero, has the wing disk invariably pink (grenadine to strawberry pink). Even if the Guatemalan condition, described as *H. guatemalae* by Saussure, proves distinct as a race or species, we do not believe that that name could be used for the northwestern Mexican insect, though the wing disk is orange in both.

BATRACHOTETRIGINAE

Brachystola behrensii Scudder

1877. *Brachystola behrensii* Scudder, Proc. Boston Soc. Nat. Hist., XIX, p. 33. [♂, ♀; Sinaloa, Mexico.]

Venvidio, VII, 27 and VIII, 14, 1918, 1 ♂, 12 ♀, 5 large juv. ♀.

Three females are of a green color phase, four show slight brownish suffusion to different degrees, while the remaining five and the male are strongly suffused with brown.

The coastal country, from southern Sonora to Tepic, is clearly the center of development of the genus *Brachystola*, though the present collection includes only a single species.

CYRTACANTHACRINAE

Chromacris colorata (Serville)

1839. *Acridium coloratum* Serville, Hist. Nat. Ins., Orth., p. 674. [♂; near South Carolina (in error).]

Villa Union, IX, 27, 1918, 1 ♀.

This handsome tropical species has a wide distribution in Mexico, reaching northward in the west as far as the above

locality, and in the east to Altamira, Tamaulipas. Though it has been recorded from both South Carolina and Texas, there is no doubt that these records are incorrect and that the species does not occur anywhere in the United States.

Leptysma mexicana (Saussure)

1861. *Opomala mexicana* Saussure, Rev. et Mag. de Zool., (2), XIII, p. 156. [Mexico.]

Rosario, 1 ♂, 2 ♀. Mazatlan, II, 21, 1918, 4 ♂, 3 ♀. Los Mochis, XII, 28, 1917 to I, 2, 1918, 7 ♂, 7 ♀, 1 juv.

This insect is more slender, with proportionately longer antennae than *L. marginicollis* (Serville), which occurs in the southeastern and southwestern United States.

In Mexico it is known on the east coast as far north as Vera Cruz, and on the west coast to San José del Cabo, Baja California.[22]

Opshomala marshalli (Bruner)

1908. *Arnilia marshalli* Bruner, Biol. Cent.-Amer., Orth., II, p. 256. [♂; Juan Viñas and Port Limón, Costa Rica.]

1908. *Arnilia propinqua* Bruner, ibid., p. 257. [♀: Atoyac, Vera Cruz, Mexico; Amatitlan and San Gerónimo, Guatemala.]

No difference from females of *marshalli* can be found in the type of *propinqua*,[23] while females indefinitely recorded at the same time from Vera Cruz and Cuernavaca, Morelos, probably represent the same species. A depauperate pair of *marshalli* from Medellin, Vera Cruz, was at the same time incorrectly referred by Bruner to his *O. minor*.[24] Though in this genus the female sex shows no safe specific characters in the majority of the species, the type locality indicates strongly that *propinqua* is a synonym of *marshalli*, while from the material it is evident that Bruner did not understand the specific values in *Opshomala*.

We find that *marshalli* is extremely close to *O. vitreipennis* (Marschall) of the southeastern United States, the former distinguished only by the broader and somewhat differently proportioned male subgenital plate. A large series of males of

[22] Six males, four females and four immature individuals are before us, bearing no further data. They were recorded by Bruner in 1908.

[23] Selected by Rehn and Hebard in 1912, Hebard Collection, Type no. 412.

[24] In consequence the present species alone is definitely known to occur in Mexico, though southward others are found, the northernmost of those being *O. minor* Bruner, from Guatemala.

vitreipennis are so constant in this difference that reduction of *marshalli* to racial status is plainly not warranted.

Mazatlan, XII, 16 to 31, 1916, 1 ♂. Venvidio, VI, 30 to VII, 3, 1918, 1 ♂, 1 ♀.

Proctolabus[25] **cerciatus** new species (Plate VII, figures 1 and 2; plate VIII, figure 1.)

Males of this species may be easily separated from those of its nearest relative, *P. brachypterus* Bruner, by the cerci, which bear a heavy flange in the region where two heavy blunt teeth are developed in that insect. The shorter organs of flight and paler coloration further distinguish the unique male of *cerciatus* before us.

Females are exceedingly similar to those of *brachypterus*, being separable only by the slightly larger head, more protruding eyes and shorter organs of flight.

Type:—♂; Villa Union, Sinaloa, Mexico. February 21, 1918. (J. A. Kusche.) [Hebard Collection, Type no. 981.]

Size medium; form cylindrical and rather elongate, normal for the genus. Fastigium and frontal costa much as in *brachypterus*.[26] Eyes very large and prominent, more protuberant than in that species. Antennae very elongate. Pronotum very similar, thickly impresso-punctulate, these slightly less decided than in *brachypterus*, but the transverse sulci more distinct, though not as marked as in *P. mexicanus* Saussure.[27] Tegmina much reduced,[28] covering less than half the distance to apex of abdomen, their apices broadly rounded. Apex of abdomen clavate. Tergite preceding supra-anal plate with free margin slightly crenulate, chitinous and blackish in lateral portions, as in *brachypterus*. Supra-anal plate shield-shaped, much as in *brachypterus;* surface unspecialized, weakly concave, lateral margins subparallel and slightly thickened in proximal half, then weakly convergent to the broad, obtuse-angulate distal

[25] For the position of this genus see Hebard, Trans. Amer. Ent. Soc., L, p. 123, (1924).

[26] Comparison is made with the single type of *P. brachypterus* Bruner, from Jalisco, Mexico, selected by Rehn and Hebard in 1912, Hebard Collection, Type no. 319. This specimen is here figured; plate VII, figures 3 and 4.

[27] Two males and a female of that brilliantly colored species are in the author's collection, from Rio Cocula, Guerrero, Mexico, originally recorded by Bruner. Rehn's queried record of *mexicanus* from Guadalajara, Jalisco, in 1904, is based on a male and two females of *brachypterus*.

[28] The tegmina in *brachypterus* are seen to show considerable individual variation in degree of reduction. This may, therefore, also prove true of *cerciatus*.

margin. Pallium large, projecting caudad as a straight, almost horizontal finger. Cerci heavy, elongate, curving distad so that they almost meet slightly beyond apex of pallium, externally appearing to have an obtuse-angulate projection mesad, in distal portion directed dorso-caudad and roughly oval, with apex resultantly much broader than in the other species. Viewed from a ventro-caudal point, the cerci are seen to have internally a heavy black flange, running from the median projection of the ventral margin to near the similarly black and cultriform distal portion of the dorsal margin, and separated from it by a small emargination which allows the pallium to project; this flange and the distal curve of the cerci make their entire disto-internal surface strongly concave. Subgenital plate short, convex, no longer than broad, with immediate apex produced as a small rounded meso-dorsal knob. Caudal femora narrowing very gradually distad, ventral margins of genicular areas moderately convex. Caudal tarsi very elongate, half as long as caudal tibiae, first two joints subequal in length, third slightly longer, not including the large arolium.[29]

Allotype.—♀; Venvidio, Sinaloa, Mexico. August 15, 1918. (J. A. Kusche.) [Hebard Collection.]

Differs from this sex of *brachypterus* only as noted above. Agrees with male, except as follows. Size much larger, form more robust. Antennae apparently decidedly shorter. Eyes large, but not as strikingly protuberant. Tegmina more reduced. Ovipositor valves elongate, distal curvature weak, margins faintly serrulate; ventral valves slightly the shorter.

Male. (*Type.*) Head buffy, cinnamon dorsad, with eyes hazel and antennae tinged with green. Pronotum dorsad cinnamon, a very broad band of vinaceous rufous separating this from the ventral half of the lateral lobes, which is warm buff. Tegmina cinnamon. Abdomen buffy, with lateral margins of tergite preceding supra-anal plate and distal margins of cerci blackish, the pallium cinnamon-brown. Limbs dull green-yellow, except the genicular areas of the caudal femora which are apricot buff marked with pink and the caudal tibiae and tarsi which are coral red.

Female. (*Allotype.*) General coloration dull green-yellow, except the eyes, tegmina, genicular areas of the caudal femora and caudal tibiae and tarsi, which are as in the male, the antennae which are irregularly annulate with pale brown, and the abdomen which is cinnamon distad. Three immature individuals are of this phase, but the other two adult females are brown in general coloration including the limbs, the one cinnamon, the other darker, verona brown with faint transverse bands

[29] In some specimens the second joint is slightly shorter than the first.

on the caudal femora. The caudal tibiae are red only on the dorsal surface and distad, while the caudal tarsi are merely tinged with red.

Measurements (in millimeters)

♂	Length of body	Length of pronotum	Greatest width of pronotal disk	Length of tegmen	Length of caudal femur
Villa Union, *type*.....	21.1	4.7	2.7	7.6	11.6
♀					
Venvidio, *allotype*.....	30.2	5.8	3.8	8.2	13.8
Venvidio, *paratype*.....	33.8	5.9	3.9	9.3	14
Venvidio, *paratype*.....	37[30]	6	4	9.5	14.1

Specimens examined: 7; 1 male, 3 females and 3 immature individuals.

Villa Union, Sinaloa, II, 21, 1918, 1 ♂, *type.*

Venvidio, Sinaloa, VI, 16 to IX, 27, 1918, 3 ♀, *allotype* and *paratypes*, 3 juv.

Abracris obliqua (Thunberg)

1824. *Gr[yllus] obliquus* Thunberg, Mém. Acad. Imp. des Sci. St. Pétersbourg, IX, p. 414. [Brazil.]

Venvidio, VII, 6 to 12, 1918, 1 ♀.

Previously published Mexican records of this species are Acapulco, Guerrero, and Temax and Valladolid, Yucatan, by Bruner as his synonymous *Omalotettix signatipes.*[31]

This insect is widely distributed in tropical America, extending northward as far as the localities noted above.

Osmilia flavo-lineata (DeGeer)

1773. *Acrydium flavo-lineatum* DeGeer, Mém. Hist. Ins., III, p. 497, pl. 42, fig. 4. [[♀], Surinam (= Dutch Guiana).]

1861. *Acridium toltecum* Saussure, Rev. et Mag. de Zool., (2), XIII, p. 163. ["Mexico temperata."]

Since Saussure's description, Mexican material has been recorded as *tolteca*, except by Stål who recorded such as *flavo-lineata*. The more robust build and coloration of the caudal femora were used by Bruner to separate *tolteca*. From examination of very large North and South American series we agree

[30] Abdomen greatly extruded.

[31] See Rehn, Trans. Amer. Ent. Soc., XLII, p. 273, (1916).

that Mexican material averages more robust than that from the Central and South American lowlands, as does material from the higher country of Costa Rica and Columbia. This feature is not sufficiently important or marked to warrant nominal recognition of any sort.[32] In most of the material from Mexico and Honduras, the external pagina of the caudal femora is less uniformly dark and polished, with ventral margin decidedly less conspicuously pale than is usual elsewhere. This feature is again insufficient for nominal separation, particularly as both phases are found in our series from the state of Vera Cruz. Our opinion is that in Mexico and Honduras differentiation in the species has begun, but that it has not reached a point justifying even racial recognition, and we consequently place *tolteca* as a synonym.[33]

Rosario, 1 ♂. Villa Union, IX, 27, 1918, 1 ♂. Venvidio, VI, 24 to IX, 27, 1918, 6 ♀.

The above records are the most northern known for the species, which is very widely distributed through the American tropics, usually occurring in a forested environment.

Schistocerca camerata Scudder

1899. *Schistocerca camerata* Scudder, Proc. Amer. Acad. Arts and Sci., XXXIV, p. 451. [♀; Sinaloa, Mexico.]

Villa Union, II, 21 and IX, 27, 1918, 3 ♂, 2 ♀, 1 juv. Venvidio, VIII, 11 to 29, 1918, 29 ♂, 8 ♀, 6 juv. Los Mochis, XII, 28, 1917, 1 ♂.

The outstanding difference between this and other Mexican species of *Schistocerca* is the heavy and well elevated medio-longitudinal carina of the pronotum, which is percurrent and produces a decidedly tectate appearance.

The markings are much like those of the more southern *S. vitticeps* (Walker),[34] the most conspicuous being a pale percurrent medio-longitudinal band on head and pronotum and the whitish external pagina of the caudal femora, with its margins usually conspicuously flecked with blackish. In several of the palest specimens of the Venvidio series, which averages decidedly

[32] It varies also in other series, individuals from British Guiana averaging slightly more slender than those from Panama, this however not being individually constant.

[33] For further discussion of the species see Hebard, Trans, Amer. Ent. Soc., XLIX, p. 266, (1923).

[34] Under which Kirby has synonymized *S. pyramidata* Scudder.

pale, the dorsal band is obsolete. The caudal tibiae vary from buckthorn brown to mummy brown, with spines and spurs in median portion always very pale, buffy.

The very decided size variation is shown by the following measurements (in millimeters) of the extremes.

♂	Length of body	Length of pronotum	Caudal width of pronotal disk	Length of tegmen	Length of caudal femur
Venvidio,.....	37.3	8.9	4.3	34.1	21.8
Venvidio,.....	33.8	7.8	3.9	30.8	20.6
Los Mochis,.....	32	6.8	3.8	26.5	19
♀					
Venvidio,.....	57	12.9	7.1	50.1	31.8
Venvidio,.....	56	12.3	6.8	45	28.2

The species is yet known only from Sinaloa.[35]

Schistocerca vaga vaga (Scudder)

1876. *Acridium vagum* Scudder, Proc. Boston Soc. Nat. Hist., XVIII, p. 269. [♀: Guadalupe Island, off Lower California; San Diego, California.]

Venvidio, VII, 20 to 22, 1918, 1 ♀. Los Mochis, XII, 28, 1917, 1 ♂, 1 ♀.

The distribution of this insect extends from the southwestern United States, southward as far as Realejo, Nicaragua. Rehn has described a race, *S. vaga brevis*, from Clarion Island, showing depauperation and reduction in the organs of flight.

Schistocerca pallens (Thunberg)

1815. *G[ryllus] pallens* Thunberg, Mém. Acad. Imp. des Sci. St. Pétersbourg, v, p. 237. [No locality stated.]

Rosario, 2 ♀.

These specimens represent the large, elongate, distinctively striped condition of the species, which varies to a phase scarcely distinguishable from *S. americana* (Drury). Similarly distinctive material is before us only from Cuernavaca, Morelos and Guadalajara, Jalisco, Mexico, and from the Greater Antilles.

The species enjoys a wide distribution through the West Indies and South America, and is usually subject to decided individual variation.

[35] The male from Rio Cocula, Guerrero, recorded by Rehn as *pyramidata* in 1900, and as *camerata* in 1901, is referable to *S. vaga vaga* (Scudder). In Bruner's quotation of *camerata* recorded by Rehn from Tacubaya, Distrito Federal, that name was apparently used in error for *carinata*.

Schistocerca americana americana (Drury)

1773. *L[ibellula][36] americana* Drury, Illustr. Exotic Ent., I, p. 128, pl. XLIX, fig. 2, index p. 2. [[♀]; Virginia, Antigua and New York.[37]]

Rosario, 2 ♀. Venvidio, VIII and IX, 2, 1918, 5 ♂, 1 ♀. Los Mochis, XII, 2 to 29, 1917, 3 ♂, 6 ♀.

Very unusual size variation, particularly in the males, is found in the series here recorded, as shown by the following measurements (in millimeters) of the extremes.

♂	Length of body	Length of pronotum	Caudal width of pronotal disk	Length of tegmen	Length of caudal femur
Venvidio,.....	36.3	7.8	4.4	32	20.2
Venvidio,.....	40.5	8.3	5.6	43.7	23.9
Los Mochis.....	43.3	8.7	5.7	43.7	24
Los Mochis.....	48.2	10	5.9	49.9	26.8

Mexican material, correctly recorded by Rehn in 1901 and 1904, from Guadalajara, Jalisco and Cuernavaca, Morelos, is also before us. The species is widely distributed through the southeastern United States and has been found northward as far as southern Ontario, but occurs typical in the West Indies only in the Bahamas. The most northwestern Mexican specimen we have seen is a female from Ensenada de Todos Santos, Baja California, a locality only about fifty miles south of the Californian boundary, secured by F. X. Williams.

We do not believe that the species is present in South America, where *S. pallens* (Thunberg) develops color phases which might easily be mistaken for *americana*. Further study must be undertaken before its presence or absence in southeastern Mexico can be determined. The species which at times has created great damage in Mexico is not *americana*, but the somewhat similarly marked migratory *S. paranensis* (Burmeister).[38]

[36] The International Commission has ruled that *Libellula* was given, in error, for *Locusta*. Until then we had recently used, for the species, the name *serialis* Thunberg, which is now reassigned to the synonymy of the present species.

[37] The type locality of this species we here select as Virginia. Additional Old World records, given by Drury, were undoubtedly based on material of other species.

[38] See Hebard, Trans. Amer. Ent. Soc., XLIX, p. 282, (1923), and Dampf, Dept. Salubr. Publ. Repub. Mexicana, Monogr. Inst. Higiene, No. 3, Seccion Parasitologia, p. 77, (1925). Though much work is yet to be done, we feel

Sinaloa behrensii Scudder (Plate VII, figure 5.)

1897. *Sinaloa behrensii* Scudder, Proc. U. S. Nat. Mus., xx, p. 40, pl. III, fig. 7. [♂, ♀; Sinaloa, Mexico.]

1917. *Sinaloa behrensii* Hebard, Proc. Acad. Nat. Sci. Phila., 1917, p. 261.

Venvidio, Sinaloa, VIII, 11 to IX, 2, 1918, 8 ♂, 16 ♀.

This is the first material of the species, in natural coloration, to be secured. It shows the following important color features for this, the genotype and largest known species of the genus. Face, genae, ventral portions of pronotal lateral lobes and parts of pleura often greenish yellow (individually varying from sulphur yellow to yellowish brown). This greenish yellow is rarely the color of the pronotal disk as well. Antennae rufous. Mediolongitudinal dark streak on head and pronotum suffused, usually feebly indicated, rarely decided, occasionally (in females) obsolete. Tegmina almost uniform light brown, usually showing some suffusion of darker ventro-proximad. Cephalic and median limbs and caudal femora greenish yellow, except the genicular areas of the latter, which are dark brown with lobes buffy. Caudal tibiae jasper red often deepening proximad, in the females sometimes becoming grayish brown or buffy proximad.

Measurements (in millimeters) of extremes

♂	Length of body	Length of pronotum	Greatest width of pronotal disk	Length of tegmen	Width of tegmen	Length of caudal femur
Venvidio,.....	19[39]	4.8	3.1	2.9	1.5	11.7
Venvidio,.....	19.2	5	3.2	3.3	1.8	12.7
♀						
Venvidio,.....	21.5	5.3	4.7	4	1.8	13.8
Venvidio,.....	26.8	6.1	5	3.8	1.9	15.7

that it is highly improbable that *americana* is a sedentary phase and *paranensis* a migratory phase of the same species. Such should be considered, however, in the light of Uvarov's discovery that in the Old World this is true for *Locusta migratoria* Linnaeus, which develops a sedentary phase, *danica*, and a migratory phase, *migratoria*, which phases had long been considered distinct species belonging to different genera. In the study of the present problem *S. pallens* (Thunberg) must also be considered, particularly in reference to its apparently strong, though possibly purely superficial, convergence toward *paranensis* in South America.

[39] This length is taken as if the abdomen were straightened out. It is usually carried recurved by the males.

Sinaloa pulchella new species (Plate VII, figure 6; plate VIII, figures 2 and 3.)

This handsome little grasshopper is closely related to *S. behrensii* Scudder, as is shown by the similarity of form and color pattern. It may easily be distinguished by its smaller size, narrower interocular space, blue caudal tibiae, male supra-anal plate lacking a proximal ridge or node mesad on each side, and male cerci with apices acute and directed dorsad, instead of being truncate.

The other species, *S. nitida* (Scudder), from Tepic, and *S. peninsulae* (Scudder), from Baja California, are very distinct.

Type:—♂; Venvidio, Sinaloa, Mexico. September 2, 1918. (J. A. Kusche.) [Hebard Collection, Type no. 982.]

Size small, form normal for the genus. Surface generally smooth, well supplied with microscopic hairs. Head with interocular space narrow, slightly narrower than the small proximal antennal joint. Vertex with sulcus distinct and lateral carinae decided between eyes, these weaker on fastigium. Fastigium feebly produced, blunt, strongly declivent, in dorsal aspect appearing twice as wide as long. Fastigio-facial angle rounded obtuse-angulate. Frontal costa with coarse lateral carinae, which are parallel (or widen slightly at the median ocellus). Eyes large and moderately protuberant, about two and one-half times as long as the infra-ocular sulcus, much longer than genae. Antennae filiform, about twice as long as pronotum. Pronotum without lateral carinae; dorsum expanding moderately on prozona, more strongly on metazona; medio-longitudinal carina very faint but percurrent; transverse sulci very fine, the two on the prozona broken mesad. Surface of prozona almost smooth, of metazona very finely and shallowly impresso-punctulate; caudal margin feebly convex, almost truncate (sometimes showing broad median emargination). Tegmina lateral, elongate ovate pads, with apices bluntly rounded and veins distinct. Prosternal process well developed, an acute finger inclined strongly caudad. Apex of abdomen moderately clavate. Furcula represented by a pair of very slender, straight adjacent processes, nearly half as long as supra-anal plate; these in lateral aspect seen to have their apices thickened and rounded. Supra-anal plate simple, shield-shaped, with medio-longitudinal sulcus present and bounded by distinct carinae only for a short distance beyond apices of furcula. Cerci extending as far as apex of supra-anal plate, rather slender, narrowed meso-proximad by concavity of dorsal margin, thence directed dorso-caudad and with margins very feebly convex to the acute apex; shaft gently incurved to apices, which become

suddenly parallel. Subgenital plate small, shorter than wide, rounded, this strongest at apex. Femora heavy. Caudal tibiae with numerous (ten) external and (eleven) internal spines.

Allotype:—♀; same data as type. [Hebard Collection.]

Size larger than male, form distinctly more robust. Interocular space broader, greater than width of proximal antennal joint; fastigium wider and blunter. Frontal costa broader, subsulcate dorsad. Antennae distinctly less than twice as long as pronotum. Caudal margin of pronotum faintly bi-convex (usually showing faint and broad median emargination). Ovipositor valves normal, with apical curvature moderately decided.

General coloration greenish yellow, with a broad postocular band of dark brown continued on each side of pronotum, but usually weak or obsolete in metazonal portion, reappearing on pleura and heavy proximad on abdomen. Eyes tawny. Antennae rufous. Tegmina brownish, suffused ventro-proximad with dark brown only in individuals of extreme intensive coloration. Caudal femora with external pagina and dorsal surface distad washed with parrot green, this occasionally broken on dorsal surface into broad, weakly defined, transverse bands; genicular areas black laterad and narrowly disto-dorsad, except lobes which are buffy often suffused with parrot green. Caudal tibiae richly dark bluish glaucous.

Frequent individuals differ in having the entire face and dorsal surface pinkish cinnamon; the genae, ventral portion of pronotal lateral lobes and pale portions of pleura, buffy.

Measurements (in millimeters), with extremes among paratypes

♂	Length of body	Length of pronotum	Caudal width of pronotal disk	Exposed length of tegmen	Width of tegmen	Length of caudal femur
Venvidio, *type*,....	13.8	3.5	2.7	2.4	1.3	8.8
Venvidio, *paratype*.	13.8	3.7	2.8	2.7	1.3	9.3
Venvidio, *paratype*.	15.3	4.1	2.9	3.5	1.8	10.1
♀						
Venvidio, *allotype*..	20.7	4.8	4.1	3.7	1.8	12
Venvidio, *paratype*.	19.2	4.3	3.6	2.8	1.3	10.7
Venvidio, *paratype*.	21.7	5	4.1	3.8	1.8	12.7

Specimens examined: 68; 28 males, 34 females and 6 immature individuals.

Villa Union, Sinaloa, IX, 21 and 27, 1918, 5 ♂, 8 ♀, *paratypes*.

Venvidio, Sinaloa, VIII, 11 to IX, 2, 1918, 23 ♂, 26 ♀, *type*, *allotype* and *paratypes*, 6 juv.

Conalcaea poecila new species (Plate VII, figure 7; plate VIII, figure 4.)

This handsome insect is very closely related to *C. humphreysii* (Thomas), which is known from southern Arizona and Sonora, Mexico. It is distinguished only by the general olivaceous coloration, weak or absent medio-longitudinal dorsal stripe of the mesonotum, metanotum and abdomen, purplish caudal tibiae which become pinkish distad,[40] more simple male cerci which are less widened distad with disto-ventral apex less produced, and male supra-anal plate (usually) with a large tubercle mesad on each side.[41]

The opposite extreme of genitalic development in this group of species occurs in *C. crassa* (Scudder), known only from the southern extremity of Baja California.

Type:—♂; Venvidio, Sinaloa, Mexico. August 28, 1918. (J. A. Kusche.) [Hebard Collection, Type no. 983.]

Size large for the genus; form robust, subfusiform. Head much as in *humphreysii*[42]; eyes large, but distinctly less than twice as long as the infra-ocular sulcus. Pronotum as in that species, lateral carinae subobsolete, medio-longitudinal carina weak but distinct, weakly cut by the three moderately decided transverse sulci; prozonal portion weakly pitted, metazonal portion finely and thickly impresso-punctulate; caudal margin broadly convex laterad and broadly concave mesad. Tegmina represented by elongate-ovate lateral pads, which are evenly rounded distad and narrow strongly proximad. Apex of abdomen

[40] We have before us a series of one male and nine females of *humphreysii*, taken at the Copete Mine, thirty miles east of Carbo, Sonora. The majority differ from all of the large series from Arizona before us in having the caudal tibiae individually varying from coral red to bittersweet orange, one alone having them buffy yellow, which is the color of these members in the more northern material. This is proof that the decided difference in coloration of the caudal tibiae in *poecila* is not as significant for specific separation as might be supposed. In addition, the majority of the Sonoran series show a general olivaceous coloration, deeper but similar to that of *poecila*, which is never shown in material of *humphreysii* from Arizona except on the caudal femora. The male cerci are, in *poecila*, of such different contour, however, that we believe specific recognition necessary.

[41] The males from Villa Union have these tubercles reduced to minute projections. In the material of *humphreysii* before us similar minute projections are occasionally present. Consequently, though this might seem to be a striking feature of difference, it cannot safely be used in distinguishing these species.

[42] Agreeing closely with the description of *C. huachucana* Rehn, Proc. Acad. Nat. Sci. Phila., 1907, p. 48, (1907).

weakly clavate. Furcula represented by very small thickenings of the tergite, causing small rounded angulations of the margins. Supra-anal plate distinctly longer than wide, lateral margins convergent and very feebly convex to the bluntly rounded apex, medio-longitudinal sulcus decided with strong lateral carinae, which are weakest mesad and become coarser in caudal portion, a decided tubercle present on each side. Cercus extending slightly beyond apex of supra-anal plate, ventral margin straight, dorsal margin broadly concave, thence rounding evenly ventrad to the ventro-caudal apex, which is sub-rectangulate and very feebly (to weakly) produced. Subgenital plate conical, its apex blunt. Cephalic and median femora robust, somewhat inflated and weakly bowed.

Allotype:—♀; same data as type, but taken August 11 to 12, 1918. [Hebard Collection.]

Very similar to females of *humphreysii*, except for the apparently unreliable features of different general coloration and color of the caudal tibiae. Differs from male in the following features. Size decidedly larger, form much more robust. Eye about one and one-half times as long as infra-ocular sulcus. Even widening of pronotal disk caudad stronger, prozonal surface almost smooth. Ovipositor valves with stout apices rather strongly curved, slightly more so than in *humphreysii*. Cephalic and median femora robust, but neither inflated or bowed.

General coloration courge green, except as follows. Eyes hays russet. Antennae coral red. Pronotum with three adjacent areas of shining black dorsad in prozonal portion of lateral lobes, the two caudad often fused, the intervals between and ventral margin of these areas greenish yellow. Abdomen often with a medio-longitudinal line of yellowish buff, and sides of proximal tergites with small blackish suffusions. Tegmina blackish brown with prominent veins buffy brown. Abdomen becoming brownish in distal portion and often tinged with tawny at apex. Ventral surface buffy brown. Caudal femora yellow ocher, the carinae forest green, the dorsal half of the external pagina varying individually from courge green to forest green, the dorsal surface often tinged with buffy or brownish. Caudal tibiae livid purple becoming deep vinaceous distad. Caudal tarsi deep vinaceous.

♂	Length of body	Length of pronotum	Caudal width of pronotal disk	Exposed length of tegmen	Width of tegmen	Length of caudal femur
Villa Union,.....	29.5	6.8	5.9	5.8	1.9	17.2
Venvidio, *type*,....	27.8	5.8	5.9	5.7	2.1	16.1
Venvidio, *paratype*.	26	5.7	5.7	4.8	1.8	16

♀	Length of body	Length of pronotum	Caudal width of pronotal disk	Exposed length of tegmen	Width of tegmen	Length of caudal femur
Villa Union,.....	37.2	8	8.9	6.3	2.2	21.9
Venvidio, *allotype*,.	34	7.2	7.9	5.3	1.9	19.8
Venvidio, *paratype*.	28.3	6.7	7.1	4.8	1.8	17.3

Specimens examined: 28; 6 males, 14 females and 8 immature individuals. Villa Union, Sinaloa, IX, 27, 1918, 2 ♂, 5 ♀.

Venvidio, Sinaloa, VIII, 11 to IX, 2, 1918, 4 ♂, 9 ♀, *type*, *allotype* and *paratypes*, 8 juv.

Aidemona azteca (Saussure)

1861. *Pl[atyphyma] azteca* Saussure, Rev. et Mag. de Zool., (2), XIII, p. 161. [♂, "Mexico temperata."]

Villa Union, IX, 27, 1918, 5 ♂, 1 ♀, 10 juv. Venvidio, VI, 24 to VIII, 6, 1918, 4 ♂, 3 ♀, and to IX, 2, 1918, 16 juv.

All of the adults in the present series are of the elongate type which is often encountered over large areas of the species distribution.

This is one of the most abundant and generally distributed grasshoppers found in central and southern Mexico.[43] It is now known to range from Sinaloa, south to Cali, Colombia.

Melanoplus complanatipes Scudder

1897. *Melanoplus complanatipes* Scudder, Proc. U. S. Nat. Mus., XX, p. 298, pl. XIX, fig. 10. [♂, ♀; Cape St. Lucas, Lower California, and Sonora, Mexico.]

Presidio de Mazatlan, (Forrer), 1 ♀. Los Mochis, XII, 2 to 10, 1917, 1 ♀.

This insect is known only from northwestern Mexico and the extreme southwestern United States. It is an inhabitant of the dry semi-desert washes and arroyos.

TETTIGONIIDAE

PHANEROPTERINAE

Insara abbreviata (Brunner)

1878. *H[ormilia] abbreviata* Brunner, Monogr. der Phaneropteriden, p. 233. [♀; Cuernavaca, [Morelos,] Mexico.]

Mazatlan, XII, 16 to 31, 1916, 1 ♀.

[43] For Mexican records see Hebard, Proc. Acad. Nat. Sci. Phila., 1917, p. 264, (1917).

The measurements of this female are as follows: length of body (abdomen extruded), 37; length of pronotum, 4.2; caudal width of pronotal disk, 2.1; length of tegmen, 13; median width of tegmen, 2.9; length of caudal femur, 22.3; length of ovipositor, 5 mm.

The species was previously known only from four specimens, all secured at Cuernavaca, in the state of Morelos.[44]

Insara sinaloae new species (Plate VII, figure 8.)

This insect, with *I. phthisica* (Saussure and Pictet) and *I. gracillima* (Brunner),[45] forms a group distinguished by the following combination of characters. Fastigium of vertex evenly declivent. Pronotal lateral lobes with a deep humeral sinus. Tegmina narrow, widest proximad, rounded at apex. Subgenital plate of male bearing non-articulate styliform appendages. Genicular lobes of cephalic and median femora bispinose.

It shows divergence toward *I. tolteca* (Saussure) and its allies, in being more robust, with the dorsal productions of the abdominal tergites stronger than in *phthisica* or *gracillima*. In spite of this, it is widely separated from that group, as further shown by the much more elongate limbs and pronotal lateral lobes, which are longer than deep.

The lamellation of the ventral margins of the cephalic and median femora distad shows, instead, agreement with *I. psaronota* Hebard and *I. lamellata* Rehn and Hebard. These species are separable from those of the present group by the very different male genitalia, much shallower humeral sinus of the pronotal lateral lobes and the fastigium of the vertex having a sudden, usually very striking, offset mesad. They, but not *sinaloae*, show a decided tendency toward *Brachyinsara magdalenae* Rehn and Hebard.

In *sinaloae* the male stridulating field is large for the genus, the shape of the pronotal disk about intermediate between that of *phthisica* and *I. bolivari* (Griffini).

[44] See Rehn and Hebard, Trans. Amer. Ent. Soc., XL, p. 83, figs. 16 and 25, (1914).

[45] These species are diagnosed and the genus revised by Rehn and Hebard, Trans. Amer. Ent. Soc., XL, pp. 65 and 68, (1914).

Type:—♂; Venvidio, Sinaloa, Mexico. September 2, 1918. (J. A. Kusche.) [Hebard Collection, Type no. 1038.]

Size somewhat above medium for the genus, form attenuate. Head much as in *gracillima*, the fastigium evenly declivent to its apex, this readily separating it from *psaronota*. Pronotal disk with length about one and two-thirds its greatest (caudal) width, its surface weakly concave, this strongest meso-cephalad; lateral carinae of disk very weak, in cephalic fifth divergent and straight, thence caudad very feebly diverging with very faint concavity, the divergence stronger and the concavity weaker in caudal portion; caudal margin of disk broadly convex with a mere suggestion of median emargination. Lateral lobes of pronotum with length slightly greater than depth, ventro-cephalic angle obtusely rounded, ventro-caudal portion evenly convex, humeral sinus deep and roundly angulate at slightly more than ninety degrees. Tegmina long and narrow, reaching slightly beyond apices of the elongate caudal femora, dorsal and ventral margins subparallel, apex rather broadly rounded (transversely almost subtruncate); marginal field distinctly broader than in *phthisica* or *gracillima*. Wings surpassing tegmina by distinctly more than the pronotal length. Four abdominal tergites preceding the last two produced meso-caudad in a small but sharp and prominent tooth, these teeth successively increasing in size caudad. Ultimate tergite with median portion concave, the lateral margins of this area subcarinate, much as in *phthisica* and *gracillima* (a supposed diagnostic difference in this feature, described by Rehn and Hebard in 1924 for those species, we believe to be attributable to warping of the tergite in drying). Cerci moderately elongate, tapering and curved inward with a faint indication of median angulation; dorsal surface concave at apex, which is armed beyond that area with a small dorsal tooth directed dorsad. Limbs very elongate. Cephalic and median femora with ventral margins rather strongly lamellate distad, their genicular lobes bispinose; caudal femora with genicular lobes strongly produced to very sharply rounded apices. Cephalic tibiae with proximal portion greatly enlarged, narrowing sharply beyond the apert tympanum, the lateral portions of this enlarged portion deplanate; median tibiae with proximal portion slightly expanded.

Allotype.—♀; same data as type, but taken in August, 1918. [Hebard Collection.]

Very similar to male, size slightly larger. Tegmina falling slightly short of apices of caudal femora. Ovipositor broad, sharply bent upward at base, the margins finely serrulate distad; dorsal and ventral margins weakly converging beyond

their strong proximal curvature to near apex, where their convergence is decided and weak convexity is indicated. Subgenital plate elongate, narrowing to the sharply rounded apex, with a coarse medio-longitudinal sulcus proximad.

General coloration individually varying from vinaceous-buff to buffy brown, some of the pale individuals washed with green; all flecked with darker brown particularly on tegmina and wings. Antennae light buff, with numerous striking annuli of dark brown in all but proximal portion. Free margins of pronotum with microscopic flecks of dark brown. Dorsal surface of abdomen apparently darkened meso-proximad, but in all the series the abdomen is poorly preserved (due to use of a too strong a solution of formaldehyde). Males with a single conspicuous fleck of dark brown at apex of tegminal stridulating field.

The characteristic streaked and speckled appearance of the species of this group is particularly prominent in the darker individuals. In many specimens, including some of the palest, a series of dark brown flecks near the apices of the tegmina are particularly noticeable.

Measurements (in millimeters)

	Length of body	Length of pronotum	Length of pronotal lateral lobe	Depth of pronotal lateral lobe	Length of tegmen	Median width of tegmen	Length of caudal femur	Length of ovipositor
♂								
Type,.....	17.8	4.3	3.7	3.2	26.3	3.7	24.8	—
Paratyprs,..	17–18.7	4.3–4.4	3.6–3.8	3.2–3.3	26.2–28.8	3.4–3.8	24–24.2	—
♀								
Allotype,...	20.5	4.7	3.8	3.3	27.2	3.8	25.8	6.3
Paratypes,..	17.5–21	4.6–4.8	3.7–3.8	3.2–3.3	23–26.8	3.3–3.7	23.9–25.1	5.9–6.2

The abdomen is swollen beyond normal size in the majority of these specimens.

Specimens examined: 27; 18 males and 9 females.

Venvidio, Sinaloa, Mexico, VIII, 8 to IX, 2, 1918, (J. A. Kusche), 18 ♂, 9 ♀, *type, allotype* and *paratypes*.

Phaneroptera paronae (Griffini)

1896. *S[cudderia] paronae* Griffini, Boll. Mus. Zool. Anat. Comp. Univ. Torino, XI, no. 232, p. 11. [♂; Colon, Panama.]

Venvidio, VII, 20 to 22, 1918, (J. A. Kusche), 1 juv. ♂.

The very heavily annulate antennae and contour of the supra-anal plate (though yet not of the mature form) enables us to determine this specimen.

The species was formerly known from Panama north to the states of Vera Cruz and Tepic, Mexico.[46]

Stilpnochlora thoracica (Serville)

1831. *Steirodon thoracicus* Serville, Ann. Sci. Nat., XXII, p. 141. [♀, "Amerique méridional."]

Rosario, 1 ♀. Venvidio, VIII, 15, 1918, 1 juv. ♂.

This is the most northern locality recorded for the species, which has often appeared in the literature under the synonymic name *tolteca*. A female, from Tepic, is in the author's collection. The insect is probably widely distributed throughout tropical Mexico, south to Costa Rica.

MONTEZUMINA new genus

This genus is erected to include a species here described, as well as *oblongoculata* Brunner, *ocularis* Saussure and Pictet and *oridiops* Saussure and Pictet, all originally referred to *Turpilia* Stål, but placed by Kirby under *Diplophyllus* Saussure.

The general form and absence of styles on the male subgenital plate show the close affinity of *Montezumina* to *Anaulacomera* Stål; these being more widely separated from the probably distinct genera *Turpilia* and *Diplophyllus* than from each other.

In *Montezumina* the structure is less delicate than is usual in *Anaulacomera*, the eyes are elongate oval, the cephalic and median tibiae are subsulcate dorsad and armed only with a single disto-caudal spine and the cephalic and median femora are heavier, with ventral surfaces sulcate and cephalic margins armed.

These genera agree in the following characters. Cephalic coxae armed with a spine. Fastigium not produced beyond plane of face, its apex blunt and in contact with frontal costa (or, in some species of *Anaulacomera*, very briefly separated from the frontal costa). Disk of pronotum smooth and flattened. Vertex evenly rounded before fastigium. Foramina of cephalic tibiae all apert. Lateral carinae of pronotum rounded. Ovipositor as long as, or longer than, pronotum, with margins serrulate distad. Male subgenital plate without styles.[47]

[46] See Rehn and Hebard, Trans. Amer. Ent. Soc., XL, p. 307, (1914).

[47] Projecting but non-articulate nodes in place of styles apparently led Saussure and Pictet, as well as Brunner, to describe inaccurately the subgenital plate of males, of all the species referred to above, as "stylis minimis (or brevissimis) instructis." This was, in part, the reason for referring them to *Turpilia*.

We here select *Montezumina oblongoculata* (Brunner) as genotype.

The original generic assignment was due to a most unsatisfactory portion of Brunner's key, resulting in still other species having been placed in *Turpilia* and later in *Diplophyllus*, which likewise belong to very different phyla.

Montezumina oblongoculata (Brunner) (Plate VII, figure 9.)

1878. *T[urpilia] oblongoculata* Brunner, Monogr. der Phaneropteriden, p. 326. [♂, ♀: Oaxaca, Mexico; Guatemala.]

Venvidio, VI, 30 to VII, 3, 1918, 1 ♂.

This katydid is probably widely distributed over tropical Mexico. The above record is the most northwestern known for the species, which is represented by material before us from as far south as Costa Rica. In that country, however, geographical racial differentiation may have taken place.

Montezumina sinaloae new species (Plate VII, figures 10 to 12.)

This species may be separated from *M. oblongoculata* (Brunner) by its slightly larger size and somewhat more delicate structure. In the male the distal curvature of the cerci is more gradual and their apices are differently shaped, while in the female the ovipositor is much longer and more gradually recurved.

Type.—♂; Venvidio, Sinaloa, Mexico. September 2, 1918. (J. A. Kusche.) [Hebard Collection, Type no. 984.]

Size large and structure rather delicate for the genus. Vertex as in *oblongoculata;* sulcate, declivent to the narrow horizontal fastigium, which is blunt at apex, less than half as wide as the proximal antennal joint and in contact with the frontal costa. Eye prominent, oblong, much longer than wide. Palpi very elongate and slender, longer than in *oblongoculata*. Pronotum as in that species; the disk flattened, gradually widening caudad, with lateral margins rounding sharply into the lateral lobes, the latter as wide as deep, with humeral sinus very deep. Tegmina and wings fully developed and very delicate, though not as delicate as in many species of *Anaulacomera*. Distal abdominal tergite as in *oblongoculata*, with large median portion sharply declivent and produced between cerci, its margins gradually converging, the distal triangular portion formed by the supra-anal plate, which is joined to it by a transverse suture. Cerci elongate, cylindrical and gradually tapering to the strongly recurved distal portion as in *oblongoculata*, but there, unlike in

that species, with erect apical portion not slender, tapering and cylindrical, but instead, gradually narrowing in caudal aspect to the apex (which is similarly armed with a minute and weakly uncinate tooth) and with caudal surface of this portion convex and cephalic surface concave, very thickly supplied with short hairs particularly on the caudal surface. Subgenital plate small with weak lateral carinae, which converge to the concave distal margin, there forming weak nodiform projections on each side (which are heavier in *oblongoculata* and in that species are best termed small styliform nodes). Ventral femoral margins armed with small but rather stout teeth, as follows; cephalic-internal 4 and 4, cephalic-external and median-internal unarmed, median-external 5 and 5, caudal-internal 3 and 5, caudal-external 7 and 8.[48] Genicular lobes of femora bidentate, except the cephalic-external, which are unidentate. Cephalic and median tibiae with dorsal surfaces deplanate and subsulcate.

Allotype.— ♀ ; same data as type, but taken August 28, 1918. [Hebard Collection.]

Agrees closely with male, differing as follows. Size very slightly larger. Ovipositor weakly and evenly curved dorsad to its acute apex, this curvature much less sharp than in *oblongoculata;* length more than that of head and pronotum, much more elongate than in that species; dorsal margin finely serrulate in slightly more than distal half, ventral margin similarly serrulate in apical portion. Subgenital plate small, simple, trigonal with blunt apex.

General coloration lumiere green. All of the series have become discolored to different degrees, due to the use of too strong a solution of formaldehyde in attempting to preserve the color. All have body, organs of flight and limbs immaculate. The females have the distal margins of the ovipositor auburn, several have a longitudinal suffusion of mummy brown proximad on the ventral valves, and in two this suffusion is percurrent, with small median suffusions of the same color on the dorsal valves as well.

The series shows little size variation, the measurements of the type and allotype being as follows: length of body, ♂, 16.2; ♀, 16.9: length of pronotum, ♂, 4.8; ♀, 5: caudal width of pronotal disk, ♂, 2.8; ♀, 3: length of tegmen, ♂, 25.2; ♀, 27.3: median width of tegmen, ♂, 5; ♀, 5.5: length of caudal femur, ♂, 19.6; ♀, 20.8: length of ovipositor, 8 mm. The extremes of tegminal length in the series are, ♂, 23 to 26.5; ♀, 25.7 to 26.3 mm.

[48] From study of the Phaneropterinae we believe that the exact number of such spines has little or no specific diagnostic value.

Specimens examined: 45; 31 males, 7 females and 7 immature individuals. Villa Union, Sinaloa, IX, 27, 1918, 1 ♀, *paratype.*

Venvidio, Sinaloa, VIII, 8 to IX, 2, 1918, 31 ♂, 7 ♀, *type, allotype* and *paratypes,* 7 juv.

Microcentrum rhombifolium (Saussure).

1859. *Ph[ylloptera] rhombifolia* Saussure, Rev. et Mag. de Zool., (2), XI, p. 204. [♂, Carolina.]

Venvidio, VI, 16 to VIII, 29, 1918, 1 ♂, 2 ♀. Los Mochis, XII, 2 to 29, 1917, 2 ♀.

This is an arboreal and thamnophilous insect which is widely distributed through the humid eastern United States and reappears in the southwestern portion of that country, where it invades the semi-arid regions, there to be found wherever cottonwood and other trees occur along permanent or seasonally dry rivers and streams. Previous Mexican records of the species can not be safely used for distributional studies, those of Rehn being referable to other species, as are almost certainly many of those by Saussure and Pictet.

Microcentrum suave Hebard

1923. *Microcentrum suave* Hebard, Proc. California Acad. Sci., (4), XII, p. 335, pl. p. 329, figs. 6 to 9. [♂, ♀: Guaymas, Sonora; Mazatlan, Sinaloa, and Tepic, Tepic, Mexico.]

Mazatlan, XII, 16 to 31, 1916, 1 ♂, *type.*

No additional material of this interesting species has been secured. It belongs to a group of species related to that which includes *M. retinerve* (Burmeister) of the humid eastern United States.

PSEUDOPHYLLINAE

Gongrocnemis pallidespinosa Brunner

1895. *Gongrocnemis pallidespinosa* Brunner, Monogr. der Pseudophylliden, p. 165, pl. VII, fig. 75. [♂, ♀; Durango, Mexico: ♀; Vera Paz, Guatemala.]

Rosario, 1 juv. ♂. Venvidio, VI, 16 to VII, 7, 1918, 1 ♂, 1 ♀, 1 juv. ♂, 5 juv. ♀.

The immature individuals all have the face shining blackish brown, no trace of such coloration persisting in the adults. The same is true of *Anchiptolis mexicanus* Saussure, as shown by adults and immature individuals in the author's collection, and we believe it to be a frequent occurrence in certain groups of the American Pseudophyllinae.

Saussure and Pictet have recorded this insect from Presidio de Mazatlan, Sinaloa, and Durango. It has been reported as far south as Guatemala. It is the northernmost species of the subfamily excepting those of the distinctive Group Pseudophyllae, the Pseudophyllinae being represented by a multitude of species in the tropics of both North and South America.

The present species was selected as genotype of *Gongrocnemis* by Rehn, in 1916. The genus is clearly a composite, including species which should be referred to at least three genera. We find *pallidespinosa* separable from *mexicanus*, genotype of *Anchiptolis*, only by the somewhat swollen dorsal surface of the cephalic tibiae, more robust form, much heavier and shorter limbs and the (usually[49]) unarmed internal genicular lobes of the caudal tibiae. The very elongate, simple, gradually incurved male cerci agree closely in these two species, but the similarly produced ultimate tergite ("supra-anal plate" of Brunner) is truncate in *pallidespinosa*, instead of bifid or bispinose as in *mexicanus*. As a result, though extremely close to *Anchiptolis*, we believe that *Gongrocnemis* should be recognized, at least until more thorough studies have been accomplished, but that it certainly includes much fewer species than has been supposed.

COPIPHORINAE

Caulopsis cuspidata (Scudder)

1881. *Conocephalus cuspidatus* Scudder, Proc. Boston Soc. Nat. Hist., xx, p. 88. [♂, ♀; Cuba.]

1881. *Conocephalus prora* Scudder, ibid., p. 89. [♀; Palvon, San Geronimo, Nicaragua.]

Through the kindness of the Museum of Comparative Zoology, we have before us the dried alcoholic type of Scudder's *prora*, which agrees in all specific diagnostic features with Cuban material of *cuspidata*. The discoloration and slightly shorter fastigium[50] apparently led Scudder to this synonymy, suggested by Karny in 1907.[51]

[49] One immature individual of the present series has one of the two internal lobes of the caudal femora armed with a small incurved spine, as in *Anchiptolis*. Though this feature is evidently individually variable in the present species, we still feel that, in combination with other characters, the usual presence or absence of such a spine may have some generic diagnostic value.

[50] From our series seen to be a matter of individual variability.

[51] Material before us from South America, however, indicates that a closely related but distinct species occurs on that continent, which has been recorded as *cuspidata* both by Redtenbacher and Karny.

Villa Union, IX, 27, 1918, 1 ♀. Venvidio, VII, 28 to VIII, 10, 1918, 2 ♂, 1 ♀.

These specimens have the fastigium slightly longer and heavier than in our Cuban series. A female from Medellin, Vera Cruz, however, has this process still longer and heavier, while in the Nicaraguan type of *prora* it is slightly shorter and as slender as in Cuban females. As the fastigium shows distinct individual variation in both the Sinaloa and Cuban series, we are convinced that the differences noted can not be used even as indices of geographic racial differentiation.

The length of the fastigium, taken from the cephalic margin of the eye to the blunt fastigial apex, is as follows: Cuba, ♂, 3.7; Havana, Cuba, ♂, 3.1; Viñales, Cuba, ♂, 3.4; Havana, Cuba, ♀, 4.1; Pinar del Rio, Cuba, ♀, 3.8; Medellin, Vera Cruz, Mexico, ♀, 5; Villa Union, Sinaloa, Mexico, ♀, 4.8; Venvidio, Sinaloa, Mexico, ♀, 4.6; Honduras, ♀, 3.8; Nicaragua, ♀, 3.7 mm.

The known distribution of this insect is defined by the above records. It is not represented in large collections from Costa Rica and Panama before us.

Neoconocephalus triops (Linnaeus)

1758. [*Gryllus* (*Tettigonia*)] *triops* Linnaeus, Syst. Nat., Ed. x, 1, p. 430. ["Indiis," (probably the West Indies).]

Los Mochis, XII, 21 and 28, 1917, 1 ♂, 1 ♀, (both green). Venvidio, VI, 20, to VIII, 10, 1918, 2 ♂, 3 ♀, 2 juv., (one male light brown, the others green).

Mexican material of this species has been recorded under the names *mexicanus*, *fuscostriatus*, *obscurellus*, probably *macropterus* and *niëtoi*. Of these the first two have been synonymized by Rehn and Hebard.[52] This nomenclatorial confusion was largely caused by the description of various color phases as species, followed by errors by Redtenbacher, which would not have occurred had that author had any conception of the geographic factors which govern the distribution of many species in America. As a result the actual distributional limits of *triops* can not be given satisfactorily. We know, however, that it occurs over the

[52] Trans. Amer. Ent. Soc., XL, p. 405, (1915).

southeastern United States and along the southwestern border as far north as Los Angeles, California, and abundantly southward through Mexico, into South America, at least as far as Guayaquil, Ecuador, and the Galapagos Islands.

CONOCEPHALINAE

Orchelimum unispina (Saussure and Pictet)

1898. *Xiphidium unispina* Saussure and Pictet, Biol. Cent.-Amer., Orth., I, p. 398. [♂; Jalisco, and Orizaba, [Vera Cruz,] Mexico.]

Los Mochis, XII, 2, 1917 to I, 2, 1918, 4 ♂, 4 ♀. Villa Union, IX, 27, 1918, 1 ♂. Venvidio, VII, 18 to IX, 2, 1918, 2 ♂, 1 ♀.

This interesting species is now known from Mulege, Baja California, and San Carlos Bay, Sonora, to Ocotlan and Guadalajara, Jalisco, in addition to the localities noted above.

Conocephalus cinereus Thunberg

1815. *C[onocephalus] cinereus* Thunberg, Mém. Acad. Imp. Sci. St. Pétersbourg, v, p. 273. [Jamaica.]

Mazatlan, XII, 16 to 31, 1916, 1 ♀.

This species is now known to have a very extensive distribution through the West Indies and tropical North and South America. In Mexico it has been previously reported only from the state of Vera Cruz,[53] but is probably generally distributed through the tropical portions of the country.

Conocephalus ictus (Scudder)

1859. *X[iphidium] ictum* Scudder, Proc. Boston Soc. Nat. Hist., XVII, p. 461. [♂, ♀; Mexico and Guatemala.]

Los Mochis, XII, 2, 1917 to I, 2, 1918, 35 ♂, 13 ♀ (all brachypterous), 5 juv. Villa Union, IX, 27, 1918, 1 ♀, (macropterous). Venvidio, VIII, 15 to 29, 1918, 9 ♂, 6 ♀, (all brachypterous).

This appears to be the most abundant species of the genus in Mexico, from San José del Cabo, Baja California, and Vera Cruz, southward through Guatemala, to San Marcos, Nicaragua.[54]

DECTICINAE

Rehnia sinaloae Rehn and Hebard

1920. *Rehnia sinaloae* Rehn and Hebard, Trans. Amer. Ent. Soc., XLVI, p. 240, pl. VIII, figs. 6 and 8, pl. IX, figs. 5 and 7. [♂, ♀, juv.; Venvidio, Sinaloa, Mexico.]

[53] See Rehn and Hebard, Trans. Amer. Ent. Soc. XLI, p. 243, (1915).
[54] See Rehn and Hebard, Trans. Amer. Ent. Soc., XLI, p. 250, (1915).

No material has been added to the originally studied six males, seven females and twenty-one immature individuals.

As stated, the species shows greatest divergence in the genus toward *Neobarrettia* Rehn.

GRYLLIDAE

TRIDACTYLINAE

Tridactylus apicialis Say

1825. *T[ridactylus] apicialis* Say, Journ. Acad. Nat. Sci. Phila., IV, p. 310. [St. Johns River, Florida; Missouri River as far as Council Buffs, [Iowa].]

Villa Union, IX, 21 and 27, 1918, 5 ♂, 4 ♀. Venvidio, VI, 16 to VIII, 1, 1918, 6 ♂, 16 ♀.

Known from Ontario to the Argentine, this insect has been reported from Mexico under the synonymic names *mixtus* (Haldeman), *terminalis* Scudder, *fissipes* Saussure and *incertus* Saussure.[55]

Ellipes minuta (Scudder)

1862. *T[ridactylus] minutus* Scudder, Boston Journ. Nat. Hist., VII, p. 425. [♂, Southern Illinois.]

Villa Union, IX, 21 and 27, 1918, 19 ♂, 19 ♀.

This is an even more frequently encountered species than the preceding, having an equally extensive area of distribution.

It has been recorded from Mexico under the synonymic name *histrionicus* (Saussure).[56]

MOGOPLISTINAE

Cycloptilum hesperum (Rehn and Hebard)

1912. *Cryptoptilum hesperum* Rehn and Hebard, Proc. Acad. Nat. Sci. Phila., 1912, p. 194, fig. 4. [♂, ♀; Sierra el Toste, San Lazaro and San José del Cabo, Baja California, [Mexico].]

Venvidio, VII, 27, 1918, 1 ♀.

This species, related to *C. antillarum* (Redtenbacher), has not been previously reported since the original description.

Cycloptilum robustum new species (Plate VIII, figure 5.)

This, the largest known species of the genus, agrees with *C. hesperum* (Rehn and Hebard) in being more robust than *C. antillarum* (Redtenbacher) and in having the male tegmina immaculate in exposed ventro-lateral portions and failing to reach the caudal margin of the pronotum mesad. The size is

[55] See Morse, Psyche, IX, p. 197, (1901), and Rehn and Hebard, Proc. Acad. Nat. Sci. Phila., 1916, p. 283, (1916).

[56] See Rehn and Hebard, Proc. Acad. Nat. Sci. Phila., 1916, p. 284, (1916).

larger and the maxillary palpi shorter and heavier than in those species with truncation of distal joint more oblique. Immature females indicate that the subgenital plate is deeply and broadly angulate emarginate, this much more extensive and broader than in *aniillarum*, while in females of *hesperum* this plate is truncate. Closer agreement, consequently, is shown in this feature alone to *C. erraticum* Scudder, of the Galapagos Islands.

Type.—♂; Venvidio, Sinaloa, Mexico. August 8 to 10, 1918. (J. A. Kusche.) [Hebard Collection, Type no. 986.]

Size large and form robust for the genus. Fastigium roundly produced and divided by a very fine medio-longitudinal sulcus, which becomes slightly stronger dorso-proximad toward the fine transverse sulcus between the antennal scrobes. Labrum pinched strongly dorso-laterad. Palpal joints heavy for the genus. Maxillary palpi with fifth as long as third joint, penultimate joint three-quarters as long; fifth joint expanding evenly and strongly to the rather strongly oblique truncate apex, the greatest apical width two-thirds the longest portion of this joint. Eyes much as in *antillarum*. Pronotum narrowing evenly cephalad, greatly produced caudad; the entire dorsal surface feebly convex, this exceedingly weak meso-caudad; caudal margin broadly convex. Tegmina wholly concealed from above by pronotum and found to fall short of its caudal margin mesad by a brief interval; from the side a considerable area of the lateral fields embrace the abdomen, this extending a distinctly shorter distance caudad than in *antillarum*, due to the longer tegminal development in that species. Cerci very elongate, nearly equal to combined length of pronotum and abdomen. A pair of recurved fangs briefly project dorso-cephalad on each side of the supra-anal plate, as in other species of the genus. Cephalic tibiae with cephalic face bearing an oval tympanum, as in *antillarum*. Caudal tibial spurs and metatarsi much as in that species. Caudal tibiae with three pairs of well developed spurs, of which the medio-internal is the longest, almost half as long as the metatarsus. Caudal metatarsus slightly over four times as long as its greatest width, the dorsal margins armed with numerous minute teeth.

Large immature females before us from the same locality have the subgenital plate rounded angulate-emarginate with lateral margins broadly convex, the emargination in ventral aspect forming an angle of about ninety degrees. Some change in the adult would be expected, but the general character of this emargination probably persists.

General coloration russet, the abdomen blackish. A very heavy covering of scales gives the insect a silver-gray facies, becoming strongly silver on the sides, while the abdomen appears obscurely annulate. Antennae immaculate, dresden brown with

a tawny tinge. Exposed portions of tegmina transparent cinnamon-buff.

Measurements (in millimeters)

♂	Length of body	Length of pronotum	Caudal width of pronotum	Length of caudal femur	Width of caudal femur	Length of cercus
Type,.....	12.7	5.7	3.8	6.8	2.7	9.7
Paratype,.....	12.2	5.9	3.8	6.8	2.7	—
Paratype,.....	12.2	5.8	3.8	6.7	2.6	—

In addition to the type, two males and two large immature female paratypes are at hand, bearing the same data, but taken from July 26 to August 26, 1918.

NEMOBIINAE

Nemobius cubensis mormonius Scudder

1896. *Nemobius mormonius* Scudder, Journ. N. Y. Ent. Soc., IV, p. 106. [♀; St. George, Utah.]

Venvidio, VI, 16 to IX, 2, 1918, 4 ♂, 8 ♀. Mazatlan, XII, 28, 1916, 1 ♀. Los Mochis, XII, 29, 1917, 1 ♀. Villa Union, IX, 27, 1918, 15 ♂, 7 ♀.

All of this series have caudate wings. The race is known to cover a large territory in the southwestern United States, reaching in Mexico as far south as Minatitlan, Vera Cruz and Teapa, Tabasco.[57]. The insect has been recorded from Mexico incorrectly as *mexicanus* Walker, *neomexicanus* Scudder, *cubensis* Saussure and as the synonymous *comanchus* Saussure.

Nemobius carolinus neomexicanus Scudder

1896. *Nemobius neomexicanus* Scudder, Journ. N. Y. Ent. Soc., IV, p. 104. (In part.) [♂, ♀: Las Cruces, New Mexico; Los Angeles (County), California; Comondu, Baja California, [Mexico].]

Villa Union, IX, 27, 1918, 8 ♂, 9 ♀. Venvidio, VI, 16 to IX, 2, 1918, 14 ♂, 18 ♀.

The distribution of this insect, which superficially closely resembles *N. cubensis mormonius* Scudder, is generally coincident with that of that race, but is known to extend even further south, being known from Costa Rica.[58] It may, however, be easily separated by the pale or very feebly suffused apices of the maxillary palpi, the shorter ovipositor with much coarser serrulations and the disto-ventral spurs of the caudal tibiae which are equal in length.

[57] See Hebard, Proc. Acad. Nat. Sci. Phila., 1913, p. 461, (1913).

[58] See Hebard, Proc. Acad. Nat. Sci. Phila., 1913, p. 484, (1913).

GRYLLINAE

Gryllodes sigillatus (Walker)

1869. *Gryllus sigillatus* Walker, Cat. Dermapt. Saltat. British Mus., I, p. 46. [♀; Swan River, [Australia].]

Venvidio, VIII, and IX, 2, 1918, 1 ♂, 1 ♀. Mazatlan, XII, 16 to 31, 1916, 2 ♂, 3 juv. Los Mochis, XII, 2 to 25, 1917, 3 juv.

This tropical household invader has been carried around the world by commerce. It has been previously recorded from Mazatlan, as the synonymous *G. poeyi* Saussure. In western America the species has not been found north of the above localities.

Miogryllus verticalis (Serville)

1839. *Gryllus verticalis* Serville, Hist. Nat. Ins., Orth., p. 343. [♀; Cayenne (= French Guiana).]

Venvidio, VII, 2 to VIII, 10, 1918, 2 ♂, 3 ♀, 1 small juv.

The specimens before us approach the maximum size for the species, are very dark and the males are rather strongly megacephalic. The extremes measure (in millimeters) as follows: length of body, ♂, 16.1 to 16.7; ♀, 16.8 to 17.7: width of head, ♂, 5.7 to 5.7; length of pronotum, ♂, 3 to 3; ♀, 3.2 to 3.7: exposed length of tegmen, ♂, 4.4 to 4.7; ♀, 3.2 to 4.1: length of caudal femur, ♂, 10.2 to 10.7; ♀, 11.3 to 11.4: length of ovipositor, 11.3 to 11.3.

This variable species is found from Staten Island, New York, over the eastern United States, through Texas into the American tropics, its distribution southward reaching the Argentine. We have previously recorded it from a number of localities in the state of Vera Cruz, Mexico.[59]

Gryllus assimilis (Fabricius)

1775. [*Acheta*] *assimilis* Fabricius, Syst. Ent., p. 280. [Jamaica.]

Los Mochis, XII, 21 to 29, 1918, 3 ♂, 3 ♀, CYbdeu2. Villa Union, IX, 27, 1918, 2 ♀, CYbu2. Venvidio, VI, 16 to IX, 2, 1918, 3 ♂, 4 ♀, CDYbdyu24. Rosario, 2 ♀, suffused EZey3. Mazatlan, XII, 16 to 28, 1916, 3 ♂, 11 ♀, 2 juv., AD suffused EXYbdeuzy2345.

The symbols used above for this very plastic and ubiquitous species are those proposed by Rehn and Hebard in 1915,[60]

[59] Journ. N. Y. Ent. Soc., XXIII, p. 115, (1915).

[60] Proc. Acad. Nat. Sci. Phila., 1915, p. 299.

at which time it was decided that all the American "species" of this genus represented mere variants of *assimilis*, which insect occurs over all but the extremities of the American continent.

OECANTHINAE

Oecanthus niveus (DeGeer)

1773. *Gryllus niveus* DeGeer, Mém. Hist. Nat. Ins., III, p. 522, pl. 43, fig. 6. [♀, Pennsylvania.]

Venvidio, VI, 16 to VIII, 1, 1918, 2 ♂. Rosario, 1 ♂. Villa Union, IX, 27, 1918, 1 ♀.

The female here recorded has the black spots ventrad on the proximal antennal joints larger and more elongate than is usual in this species.

This insect is widely distributed through the United States and Mexico, reaching as far south as Guatemala.

Oecanthus varicornis Walker

1869. *Oecanthus varicornis* Walker, Cat. Dermapt. Saltat. British Mus., I, p. 94. [♂, Mexico.]

Venvidio, VII, 26, 1918, 1 ♂.

This handsome, elongate species was hitherto known from the states of Tepic and Vera Cruz, Mexico, south to northern Panama.

Oecanthus nigricornis Walker

1869. *Oecanthus nigricornis* Walker, Cat. Dermapt. Saltat. British Mus., I, p. 93. [♀, Illinois.]

1874. *Oecanthus argentinus* Saussure, Miss. Sci. Mexique, Rech. Zool., VI, p. 460. ["La Plata."[61]]

Los Mochis, XII, 2 to 10, 1917, 1 ♂, 2 ♀. Villa Union, IX, 27, 1918, 1 ♀.

These specimens agree closely with material from California, which we believe represents the pale color phase of this species.

[61] In 1897 Saussure recorded as *argentinus* material from Dallas, Texas; Ciudad, Durango, and Mazatlan, Sinaloa, and questioned the accuracy of the locality originally given for the species. There is no doubt that the present material represents the same as that so recorded by Saussure from Texas and Mexico. We can find no difference to separate this insect from Walker's *nigricornis*, of which we have large series, and consequently indicate here the synonymy of *argentinus*.

TRIGONIDIINAE

Cyrtoxipha gundlachi Saussure

1874. *Cyrtoxipha gundlachi* Saussure, Miss. Sci. Mexique, Rech. Zool., VI, p. 373. [♂, ♀: Cuba; southern United States.]

Venvidio, VI, 16 to VII, 6, 1918, 4 ♀.

These specimens are inseparable from the larger females in a large series before us from Florida, Cuba and Jamaica. The species was previously unknown from Mexico.

Anaxipha tolteca (Saussure)

1874. *Cyrtoxipha tolteca* Saussure, Miss. Sci. Mexique, Rech. Zool., VI, p. 376. [♀; Orizaba, Vera Cruz, Mexico.]

Venvidio, VI, 16 to VII, 22, 1918, 1 ♂, 5 ♀, 3 juv.

Under *tolteca* we have recently[62] synonymized *Cyrtoxipha angusticollis* Saussure, based on a male, also from the Cordillera Oriental, Mexico.

Material before us shows that this species reaches southward as far as Panama.

ENEOPTERINAE

Paroecanthus aztecus Saussure

1874. *Paroecanthus aztecus* Saussure, Miss. Sci. Mexique, Rech. Zool., VI, p. 471. [♂, ♀; Mexico.]

We do not feel that the species of this genus are as yet sufficiently understood to warrant placing this name under *P. annulatus* (Scudder), described from Central America, as has been done by Kirby. We do believe, however, that part of Saussure's material recorded in 1897 probably represents that species, this applying particularly if not wholly to that part of the series from south of Mexico.

Venvidio, VII, 26, 1918, 1 ♀.

Compared with Costa Rican females of *annulatus*, this specimen is seen to be decidedly larger, with dorsal surface of cephalic tibiae slightly heavier but not distinctly swollen above the foramen, as is the case, to very similar degree, in all of the eleven Costa Rican adults at hand. Its measurements are: length of body, 24.7; length of pronotum, 4.8; caudal width of pronotal disk, 5.8; length of tegmen, 22; projection of wings beyond tegmina, 4.5; length of caudal femur, 13.7; width of caudal femur, 4.5; length of ovipositor, 6.8 mm.

[62] Proc. Acad. Nat. Sci. Phila., LXXVI, p. 240, (1924).

Paroecanthus mexicanus Saussure

1859. *Paroecanthus mexicanus* Saussure, Rev. et Mag. de Zool., (2), XI, p. 317. [Mexico (by inference).[63]]

Venvidio, VIII, 1918, 1 ♀.

Unlike the specimen of *P. aztecus* Saussure, here recorded, this female has the dark markings laterad on the dorsal fields of the tegmina subobsolete; the caudal femora not very dark distad, but also with a pregenicular suffusion, and the bases of the caudal tibial spines immaculate. All of these features of coloration are probably subject to great individual variation and the much smaller size of the present specimen is, apparently, the most dependable feature to separate it from the individual recorded as *aztecus*. They are so very different, however, in general appearance that we feel obliged to place them as representatives of distinct species.

The measurements of this female are: length of body, 14; length of pronotum, 3.8; width of pronotal disk, 4.7; length of tegmina, 17.5; projection of wings beyond tegmina, 3.8; length of caudal femur, 11.3; width of caudal femur, 3.1; length of ovipositor, 6 mm.

This species has been reported in Mexico from as far northeast as Alta Mira, Tamaulipas, and south to Teapa, Tabasco.

[63] Subsequently given by Saussure as Mirador and Tampico.

EXPLANATION OF FIGURES

Plate VII

Fig. 1.—*Proctolabus cerciatus* new species. Male. *Type.* Villa Union, Sinaloa, Mexico. Lateral view of cercus. (Much enlarged.)

Fig. 2.—*Proctolabus cerciatus* new species. Male. *Type.* Villa Union, Sinaloa, Mexico. Distal view of apex of cercus. (Same scale as fig. 1.)

Fig. 3.—*Proctolabus brachypterus* Bruner. Male. *Type.* Jalisco, Mexico. Lateral view of cercus. (Same scale as fig. 1.)

Fig. 4.—*Proctolabus brachypterus* Bruner. Male. *Type.* Jalisco, Mexico. Distal view of apex of cercus. (Same scale as fig. 1.)

Fig. 5.—*Sinaloa behrensii* Scudder. Male. Venvidio, Sinaloa, Mexico. Lateral view of cercus. (Much enlarged.)

Fig. 6.—*Sinaloa pulchella* new species. Male. *Type.* Venvidio. Sinaloa, Mexico. Lateral view of cercus. (Same scale as fig. 5.)

Fig. 7.—*Conalcaea poecila* new species. Male. *Type.* Venvidio, Sinaloa, Mexico. Lateral view of cercus. (Much enlarged.)

Fig. 8.—*Insara sinaloae* new species. Male. *Type.* Venvidio, Sinaloa, Mexico. Dorsal outline of pronotal disk. (Much enlarged.)

Fig. 9.—*Montezumina oblongoculata* (Brunner). *Male.* Venvidio, Sinaloa, Mexico. Lateral view of cercus. (Much enlarged.)

Fig. 10.—*Montezumina sinaloae* new species. Male. *Type.* Venvidio, Sinaloa, Mexico. Lateral view of cercus. (Same scale as fig. 9.)

Fig. 11.—*Montezumina sinaloae* new species. Female. *Allotype.* Venvidio, Sinaloa, Mexico. Lateral view of ovipositor. (× 3)

Fig. 12.—*Montezumina sinaloae* new species. Female. *Allotype.* Venvidio, Sinaloa, Mexico. Ventral view of subgenital plate. (Much enlarged.)

Plate VIII

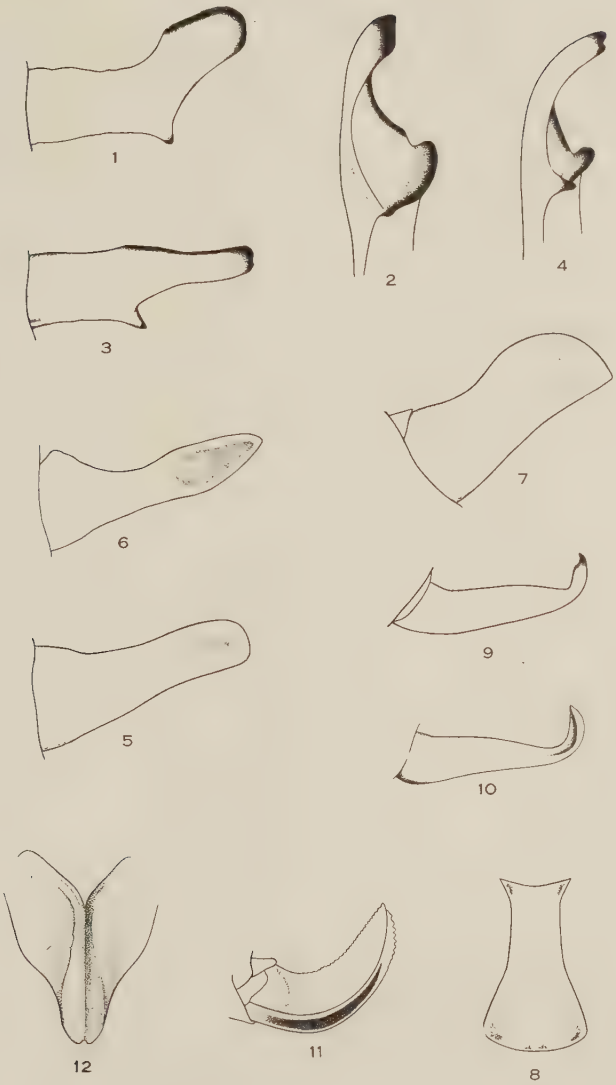
Fig. 1.—*Proctolabus cerciatus* new species. Male. *Type.* Villa Union, Sinaloa, Mexico. Lateral view. (× 2½)

Fig. 2.—*Sinaloa pulchella* new species. Male. *Type.* Venvidio, Sinaloa, Mexico. Dorsal view of apex of abdomen. (Much enlarged.)

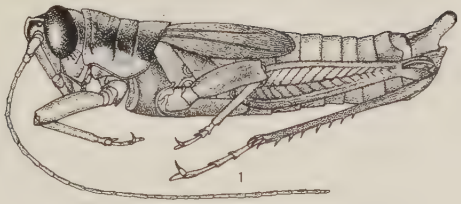
Fig. 3.—*Sinaloa pulchella* new species. Female. *Allotype.* Venvidio, Sinaloa, Mexico. Lateral view. (× 2½)

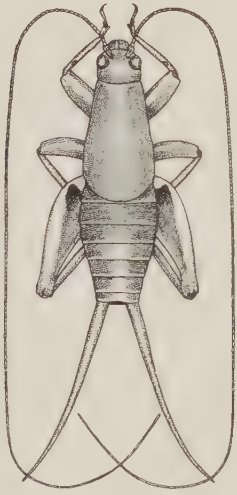
Fig. 4.—*Conalcaea poecila* new species. Male. *Type.* Venvidio, Sinaloa, Mexico. Dorsal view of apex of abdomen. (× 7)

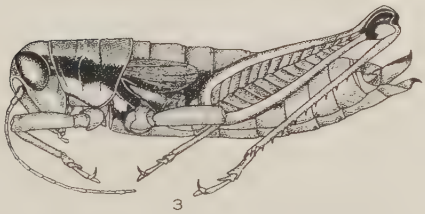
Fig. 5.—*Cycloptilum robustum* new species. Male. *Type.* Venvidio, Sinaloa, Mexico. Dorsal view. (× 3)



HEBARD DERMAPTERA AND ORTHOPTERA FROM SINALOA, MEXICO







HEBARD—DERMAPTERA AND ORTHOPTERA FROM SINALOA, MEXICO

ON THE ANATOMY OF THE HEAD AND THORAX IN RANATRA (HETEROPTERA)[1]

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The literature on the anatomy of *Ranatra* seems to be confined to a very few papers. Among these should be mentioned first the one by Dufour (1833), "Recherches Anatomiques et Physiologiques sur les Hemipteres," which is usually cited as the basis for all morphological work on the Hemiptera, although the paper was written nearly one hundred years ago. In addition to this work, the paper by Locy (1884) on "The Anatomy and Physiology of the Family Nepidae," and the one by Marshall and Severin (1904) on "Some Points on the Anatomy of Ranatra fusca" constitute practically all of the literature on the morphology of this genus. There are, however, a number of papers dealing with the Nepidae, but in none of these was *Ranatra* studied, the work being based entirely upon *Nepa*, another genus of the family Nepidae to which *Ranatra* belongs.

In this study of the genus *Ranatra* three species were available, *R. fusca* Palisot de Beauvois, *R. nigra* Herrich-Schaffer, and *R. kirkaldyi* Bueno. By far the greater number of specimens studied were *R. fusca*, hence this species may be considered as a basis for the work. Several dissections of *R. kirkaldyi* and two of *R. nigra* showed them to agree with *R. fusca* except in minor detail, such as length or size of structures, depth of fissures or grooves and similar comparative characteristics. Where marked differences occur in the parts described in this paper they are mentioned in the text.

External Anatomy of the Head

The head of *Ranatra* as seen from the side is rather long and slender, the beak extending directly forward. Across the eyes the head is slightly wider than the anterior part of the prothorax,

[1] This work was done under the direction of Dr. C. H. Kennedy as part of the thesis requirement for the degree Master of Science at the Ohio State University.

each eye being almost as wide as the part of the head between them. The beak consists of three segments, the basal one of which is sub-triangular, the second nearly rectangular, and the third somewhat pointed anteriorly. Attached to the second segment on its dorsal surface and near its anterior end are two small plates (rp, Fig. 1a) which are likely the rudiments of labial palps. At the tip of the third segment there are a number of hairs (sh, Fig. 1a) which undoubtedly serve as sense hairs in feeling over the surface the insect is about to pierce.

At the base of the beak there are two lateral sclerites, known as the maxillary plates (mp, Fig. 1), to the inner surfaces of which the extensor muscles of the maxillary setae are attached (pemx, Fig. 6). The maxillary plates extend over both the ventral and dorsal surfaces of the anterior part of the head. From them there project on each side a number of hairs or bristles (h, Fig. 1) that curve around and point posteriorly over the top of the labrum. Along the inner edge of the ventral surface of this lateral sclerite and near its posterior end is the opening (pgp, Fig. 2) of the prothoracic or poison gland to be described later. Extending into the dorsal surface of the head from the posterior margin of each maxillary plate there occurs a rather prominent groove (mg, Fig. 1). The depth of this groove varies in the different species, in *R. fusca* and *R. kirkaldyi* it being very prominent, while in *R. nigra* it is much less prominent. The internal attachments, however, are the same in the three species, there being a heavy chitinous plate extending into the head to form the framework of the sucking pharynx (fsph, Fig. 3).

Glands of the Head and Prothorax

There are two distinct and separate pairs of glands in the anterior part of the body of *Ranatra*. The larger pair was originally described by Dufour as the salivary glands. He thought, however, that there were two efferent canals, although the external openings were not located. He also mentioned two pairs of salivary reservoirs, the anterior pair of which is undoubtedly the second pair of glands. He was unable to show any connection between the glands and their so-called reservoirs. Locy writes of these glands that they open near the commencement of the oesophagus and that they likely aid in digestion.

Marshall and Severin state that they were unable to trace the two ducts farther than the anterior part of the head. They maintain that the so-called salivary receptacle is either a separate gland or at least a glandular portion of the salivary gland. The duct of the salivary receptacle was also traced into the head, no connection with the salivary gland being found.

The Salivary Gland

Inasmuch as these glands have been fully and accurately described in the above mentioned papers, only their connections with the salivary receptacle and the alimentary canal will be taken up here. Reference to the illustration (Fig. 4) will show at once that the two ducts of each gland after leaving the gland (salg, Fig. 4) pass forward into the head, but that one reverses on itself beside the cerebral ganglion, extends posteriorly past the glands and leads back to the salivary receptacle (sr, Fig. 4). A duct-like tubular portion continues posterior to the enlarged receptacle. This portion is much larger than the true duct of the receptacle and seems to have a glandular structure as Marshall and Severin have indicated. From their structure and their relations with the glands we are led to conclude that they are salivary receptacles that have taken on a glandular function, which is the conclusion reached by Lefebvre for *Nepa*. It will be observed, however, that the only connection this structure has with the digestive system is out through the efferent duct of the gland (ed, Fig. 4). This means that if there is any secretion from the glandular walls of the salivary receptacle it must pass forward into the head, then back to the glands and again forward through the true efferent duct. Any secretion of the gland (salg) that may be stored in the receptacle must of course pass out through the same channel. The true efferent duct (ed) after entering the head passes under the salivary pump (sp) and opens into it immediately in front of the bell-shaped part (red and led, Fig. 5). The two ducts from opposite sides do not join but open side by side.

The Poison Glands

Locy (1884) found and described as the cephalic glands a pair of glands occurring in the head of *Belostoma*. He described them as green glands similar to those occurring in the Crustacea.

He reported having found them in *Ranatra* but gave no illustration or description. Dufour saw these glands but called them a second pair of salivary receptacles. Marshall and Severin seem to have seen them but interpreted them as air bladders, or at least they figure air bladders as occurring in the identical position of these glands which are extremely delicate and, after standing in a preservative, take on the appearance of air bladders.

These glands were originally named cephalic glands by Locy because of the fact that they were located in the head in *Belostoma*. Bordas after describing them for *Nepa* called them cephalothoracic glands because they were located partly in the head and partly in the prothorax. In *Ranatra* the glandular portion (pg, Fig. 4) is located entirely within the prothorax, the ducts (pgd) alone extending into the head. The glands are white, are sub-cylindrical in shape, and lie on the ventral wall, below the sub-oesophageal ganglion. Posteriorly they extend to the middle of the prothorax, the glandular portion reaching forward to a little beyond the posterior edge of the ganglion.

The glands are of a very delicate texture, consisting of conical cells with the apex towards the center. The cells open into a central cavity which serves as a conducting chamber for the secretion. In *Ranatra* the central cavity of this gland is much smaller than in *Belostoma* (*Zaitha*), the glands being much more slender in the former. The cells also are longer than they are in the Belostomids. The duct of this gland in *Ranatra* has very thin transparent walls and because of this will often escape observation while lying on the ventral wall of the head. As shown in the illustration (pg, Fig. 4) the two glands lie very closely approximated to each other, while the two ducts draw apart as they enter the head. The external pore (pgp, Fig. 2) is rather prominent in *R. kirkaldyi*, occurring at the center of a slight protuberance. It is not so prominent in the other two species examined although it is still discernible.

As shown by the illustration there is no connection whatever with the alimentary canal nor with the beak. For this reason it is difficult to understand just what their function may be. Locy first advanced the idea that they were poison glands and stated that when he introduced the secretion into the body of an insect it produced death very quickly. Lefebvre introduced some of the secretion from *Nepa* into a lancet puncture

in his hand and found that it produced a sharp burning sensation and a blister soon followed. This did not occur when the same thing was tried with the secretion from the other pair of glands. Consequently, he also concluded that these were the poison glands. It seems strange, however, that glands of this kind should open on the ventral surface of the head where there is no way of getting into the beak. It thus cannot be injected into the insect prey. It might serve to cause an unpleasant mouthful for some predaceous enemy. The secretion is a white milky fluid. The writer has observed it to gush out very profusely upon irritation in case of *R. nigra*.

The Maxillae and Mandibles

Ranatra is one of the predaceous Hemiptera and consequently gets its food by piercing other aquatic organisms and sucking their blood. As is usual the maxillary and mandibular setae form the sucking tube, the two pairs lying in a groove in the labium which forms the beak, the maxillae being enclosed within the mandibles. Extending through the first and part way into the second segment of the labium is the labrum (lbr, Figs. 5 and 6) which forms a sort of inverted trough in which the setae are enclosed. The labrum merges posteriorly into the clypeus. The maxillae are attached by retractor muscles (rmx, Fig. 6) to two tendons (t, Fig. 6) in the prothorax. These tendons are the dorsal pair of the four that serve to move the head. Each tendon is an extension backward of a part of a lateral sclerite of the head, as is shown by the thickened, triangular, chitinous plate (scl, Fig. 6) at the anterior end of the tendon, this plate being a part of the head structure. The chitinous tendon (t) itself is attached posteriorly to the mesothorax and serves to move the head dorsad and laterad. The extensor muscle of the maxilla (emx, Fig. 6) is extremely long, extending from about the same point at which the retractor muscle is attached, into and through the head and attaches to the maxillary plate at the extreme anterior portion of the head. In the middle of this plate on the interior surface a pocket is formed with a circular chitinous wall (pemx, Fig. 6). It is within this pocket that the muscle is attached. Throughout

their full length the maxillary setae are enclosed in a sheath which is attached to the long chitinous plate (pl. Fig. 5) that forms a basis of attachment for the muscles of the salivary pump. The length of the extensor muscle would seem to permit a great extension of the maxilla in probing about through the body of an insect for blood.

The mandibular setae (md, Figs. 5 and 6) attach by retractor muscles (rmd, Fig. 6) to the ventral posterior portion of the head, just below and in front of the occipital foramen. For the extensor muscle there is a remarkable lever arrangement which, however, seems to be fairly characteristic of Hemipterous insects. The posterior part of the mandibular seta is enlarged for the reception of the retractor muscle. Anterior to this enlargement there is a powerful but slender transparent cord that connects the seta with a sub-triangular plate (stp, Fig. 6). This plate is attached by one angle (z) to the ventro-lateral wall of the head near the point where the mandibular groove forms an extension into the head cavity. Attached to the other angle of the sub-triangular plate is the band of muscles (emd, Fig. 6) which is connected with the dorsal wall of the head. Due to the lever arrangement a contraction of this muscle causes a sudden extension of the mandibular seta. This would seem to fit them especially as piercing structures. After the prey has been pierced by the mandibular setae, the maxillary setae, which lie within the mandibular setae, probe the captured organism and suck up its juices. In teasing individuals to cause them to pierce objects the writer has repeatedly observed this thrusting forward of the mandibles followed by the slower extension of the maxillae.

The Sucking Pharynx

Food is drawn up through the setae by means of the sucking pharynx (sph, Fig. 5). The contraction of the pharyngeal muscle (msph, Fig. 5) raises the roof of the pharynx (rsph) causing a partial vacuum in the sucking pharynx below. Since the only opening to the sucking pharynx is through the sucking tube the fluid is drawn up through the pharynx. The mandibles and maxillae spread apart immediately under the hypopharynx

as indicated in Figure 3 (hyp), the maxillae being fitted under two grooves in the hypopharynx in such a way that there is close contact with it. The fluid thus passes up over the tongue of the hypopharynx and back into the pharynx, the floor of the sucking pharynx (fsph, Fig. 3) being a continuation backward of the hypopharynx. From here the food passes on into the oesophagus (oes, Fig. 5). The floor of the pharynx is formed by a heavy plate projecting inward and forward from the deep grooves (mg, Fig. 1) of the head. This plate is strongly and heavily chitinized and is arranged in the form of a U-shaped trough, being deeper at the middle than at the sides. The roof of the pharynx is formed by a thin and flexible chitinous plate that, extended forward, becomes the epipharynx (ep, Fig. 5). This fits very closely over the floor of the pharynx, the two plates finally fusing posteriorly to form the oesophagus. The strong muscles that raise the roof of the pharynx are attached to the median portion of the head probably in the region known as the "front", although the different sclerites are not well marked off from each other over the top of the head.

The Salivary Pump

This is a bell-shaped structure (sp, Fig. 5) lying underneath the hypopharynx and other mouthparts. It is connected with the mouth by an opening under and immediately in front of the hypopharynx (spo, Fig. 5). This opening is covered by a tongue-like projection that forms a sort of valve (sv, Fig. 5) to the salivary pump. The salivary ducts, right and left, (red and led Fig. 5) enter the pump immediately in front of the bell-shaped structure (sp, Fig. 5). Extending posteriorly from the open part of the bell is a chitinous rod (r), to each side of which are attached the muscles (pmsp, Fig. 5) that operate the pump. This is known as the plunger or piston of the pump. From the sides of the salivary pump in front of the bell-shaped structure there extend backward two broad, flat, chitinous plates (pl. Fig. 5). It is on these plates that the muscles have their basis of attachment for operating the salivary pump. A contraction of the muscle (pmsp) everts the infolded part of the bell-shaped structure, causing a partial vacuum in the pump cavity (pc).

This draws the fluid from the salivary glands and reservoir. After relaxation of the muscle (pmsp) the natural elasticity of the bell structure forces the secretion out through the above mentioned opening (spo, Fig. 5). If the salivary glands are digestive, as is commonly thought, the salivary pump would operate at the same time the sucking pharynx is operating, and the secretion would be drawn into the pharynx along with the food. If, on the other hand, the glands should secrete a poison, which the writer is inclined to suspect in spite of the evidence cited to the contrary, the pump would readily force the secretion out through the stylets into the victim while the sucking pharynx is at rest. The writer has observed small drops on the ends of the stylets while specimens were attempting to pierce objects presented to them. These droplets must have been the secretion from the salivary glands but whether it is poisonous or not has not been determined.

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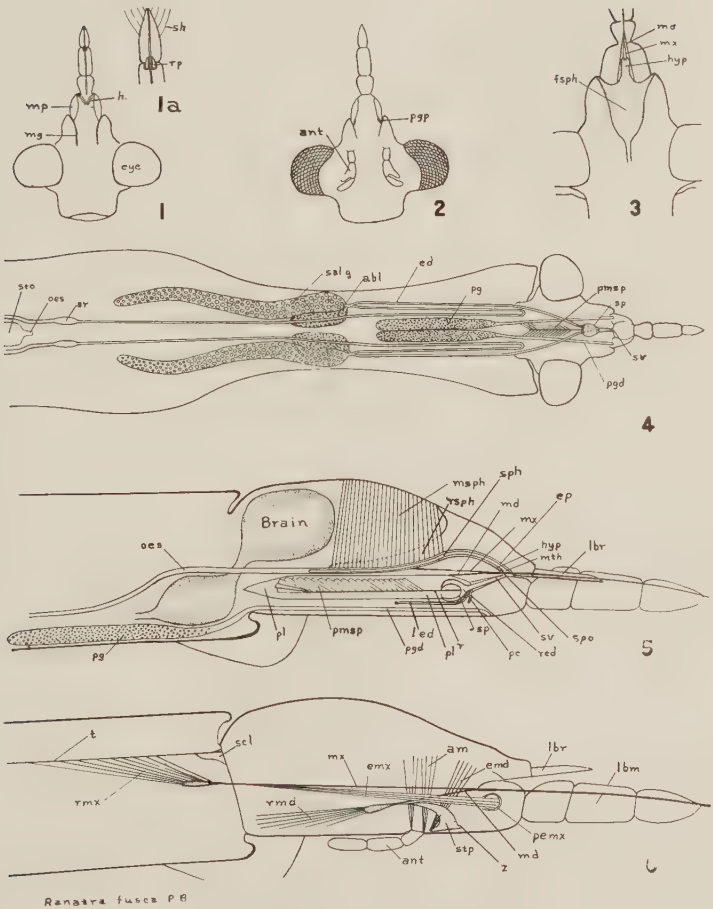
EXPLANATION OF PLATE IX

Fig. 1.—Head of *Ranatra fusca* from dorsal aspect.
Fig. 1a.—Tip of labium showing rudimentary palps and sense hairs.
Fig. 2.—Head of *Ranatra fusca* from ventral aspect showing position of poison gland pore.
Fig. 3.—Diagram of head showing floor of sucking pharynx and relative position of setae and hypopharynx.
Fig. 4.—Diagram of head and prothorax of *Ranatra fusca* from dorsal aspect, showing glands and salivary pump.
Fig. 5.—Lateral aspect of head of *Ranatra fusca* showing the sucking pharynx and salivary pump.
Fig. 6.—Lateral aspect of head of *Ranatra fusca* showing the muscle attachments of the mandibular and maxillary setae.

Abbreviations used on Plate

abl —Aberrant lobe of salivary gland.
am —Antennal muscle.
ant —Antenna.
ed —Efferent duct of salivary gland.
emd —Extensor muscle of mandible.
emx —Extensor muscle of maxilla.
ep —Epipharynx.
fsph —Floor of sucking pharynx.
h —Brush of hairs or bristles.
hyp —Hypopharynx.
lbm —Labium.
lbr —Labrum.
led —Left efferent duct of salivary gland.
md —Mandibular seta.
mg —Mandibular groove.
mp —Maxillary plate.
msph—Muscle of sucking pharynx.
mx —Maxillary seta.
oes —Oesophagus.
pc —Cavity of salivary pump.
pemx—Pocket for attachment of extensor muscle of maxilla.
pg —Poison gland.
pgd —Poison gland duct.
pgp —Poison gland pore.
pl —Chitinous plate for attachment of muscle of salivary pump.
pmsp—Plunger muscle of salivary pump.
r —Chitinous rod serving as piston of salivary pump.
red —Right efferent duct of salivary gland.
rmd —Retractor muscle of mandible.
rmx —Retractor muscle of maxilla.

rp —Rudimentary labial palps.
rsph —Roof of sucking pharynx.
salg —Salivary gland.
scl —Chitinous sclerite to which tendon attaches.
sh —Sense hair.
sp —Salivary pump.
sph —Sucking pharynx.
spo —Salivary pump opening.
sr —Salivary receptacle.
sto —Stomach.
stp —Subtriangular plate forming lever for mandible.
sv —Valve of salivary pump.
t —Tendon serving as attachment for retractor muscle of maxilla.
z —Angle at which sub-triangular plate is attached to ventral wall of head.



NEISWANDER ON ANATOMY OF HEAD AND THORAX OF RANATRA

THE NORTH AMERICAN GENUS INSCUDDERIA (ORTHOPTERA, TETTIGONIIDAE, PHANEROPTERINAE)

BY MORGAN HEBARD

During the summer of 1915, while working in a small group of cypress (*Taxodium*) at Greenville, Mississippi, the author took a small series of a striking and undescribed katydid, evidently related to the genus *Phaneroptera* Serville.[1] In 1921 Caudell[2] described the genus *Inscudderia* and a single species, *taxodii*, from males taken that year at Durant, Mississippi, and apparently representing the same insect. Comparison of our material with his type has since proven this beyond question, differences in Caudell's description and figures being entirely due to the fact that the type is distorted and in bad condition, from drying after immersion in a liquid preservative.

In 1917 a small "bay" of cypress was examined at Kissimmee, Florida, by Rehn and Hebard, and adult females and young of a similar but much larger insect were secured after long search. The desirability of finding Floridian males was communicated to Messrs. T. H. Hubbell and F. W. Walker, and a magnificent series has been taken by them, showing conclusively that a distinct species is represented.

These two species are similar in general appearance, the delicate black tracery on the green tegmina plainly suggesting the delicate foliage of the cypress in which they dwell.

Critical comparison with the species belonging to *Phaneroptera* further shows that Scudder's *strigata* must also be referred to *Inscudderia*. In that distinctively marked species the produced and specialized male ultimate tergite is, however, of a similar type to that of *Phaneroptera curvicauda* (DeGeer), demonstrating that in this genus, as in *Phaneroptera* the type of this plate differs widely in the species, but has no generic diagnostic value.

[1] Known as *Scudderia* Stål until Caudell's genotypic fixation in 1921.
[2] Journ. Washington Acad. Sci., XI, p. 489.

The genus *Inscudderia* is, in fact, much closer to *Phaneroptera* than Caudell supposed, and is widely distinct from *Insara* Walker. The two genera, and the species of the former, may be separated as follows:

A. Tegmina decidedly broader, moderately narrow to broad; proximal branch of median vein forking, these forks reaching the sutural margin. General coloration immaculate green (rarely marked with brown)..... *Phaneroptera* Serville

AA. Tegmina decidedly narrower, narrow, proximal branch of median vein joining the ulnar vein. General coloration green, strikingly marked with brown and black... *Inscudderia* Caudell

B. Male ultimate tergite not produced. Male subgenital plate narrow in lateral aspect. Tegmina green, with median vein, stripe along juncture of discoidal and anal fields and veins running to that margin for a short distance, blackish brown.[3]

C. Size large. Distal specialization of male ultimate tergite much narrower than the tergite, its lateral production much less prominent. Apical tooth of male cercus shorter. Subgenital plate with apex less specialized. *walkeri* new species

CC. Size small. Distal specialization of male ultimate tergite only slightly narrower than the tergite, its lateral production very prominent. Apical tooth of male cercus very elongate. Sugenital plate with apex more specialized..... *taxodii* Caudell

BB. Male ultimate tergite produced, with apex expanded into two truncate lobes. Male subgenital plate broad in lateral aspect. Tegmina green, with a blackish brown longitudinal stripe margining anal field, which is rich cinnamon, meso-proximad with a suffusion of blackish brown..... *strigata* (Scudder)

The limbs in the species of *Inscudderia* are elongate and slender but not sufficiently more so than in *P. curvicauda* (DeGeer) (genotype of *Phaneroptera*) to warrant use as a generic character. The lateral carinae of the pronotum are rounded and weak cephalad, but no more than in the distinctive *P. septentrionalis* Serville, which like two of the species of *Inscudderia* in the male shows no production of the ultimate tergite (but has broad tegmina, with venation normal for *Phaneroptera* and comparatively short limbs). The armament of the ventral femoral margins may be said to be heavier in *Inscudderia* than in any species

[3] See more detailed description under *walkeri*.

of *Phaneroptera*, but there is sufficient individual variation to make this of little generic diagnostic value.

Inscudderia walkeri new species (Plate XI, figures 1 to 5.)

We take pleasure in naming this species, one of the most striking of the Eastern katydids, in honor of Mr. F. W. Walker. Through his remarkable ability in the field, not only was the major portion of the very large series of this new species secured, but also equally unusual representations of a number of other forms, previously unknown, or represented in collections by but few specimens.

The present Floridian species is readily distinguished from *I. taxodii* Caudell, of the southern Mississippi Valley, by its much larger size and striking male genitalic differences. Most important of these are the ultimate tergite with distal specialization less decided and very much less in width than the tergite, the much shorter and heavier cercal tooth and the simpler apex of the subgenital plate.

These two species are otherwise generally similar and very distinct from the third known species of the genus, *strigata* (Scudder).

Type.—♂; Waldo, Alachua County, Florida. August 23, 1924. (F. W. Walker.) [Hebard Collection, Type no. 1037.]

Size much larger, form similar to *taxodii*. Head, pronotum, tegmina, wings and limbs much as in that species. Tegmina with ulnar vein sending four (or five) branches to the sutural margin, the last (usually) forked,[4] the vein itself curving distad to that margin; median vein sending proximal branch to the ulnar vein and two branches to the sutural margin. Tegmina narrow, marginal field transparent between veinlets. Ultimate tergite broad, its median portion distad raised and flattened, produced laterad in rounded projections, the margin between weakly concave mesad. This process is much smaller in proportion to the tergite than in *taxodii* and its lateral projections are much less decided than in that species. Supra-anal plate narrowing and declivent proximad, thence produced as a straight finger slightly beyond (and usually below) the cercal apices, its dorsal surface very deeply and broadly sulcate to near apex. Cerci moderately elongate, tapering and cylindrical to near distal portion, which is swollen and bent inward, surmounted

[4] Occasional individuals have, instead, two branches which spring from the same point on the ulnar vein.

by a heavy tooth, the disto-caudal surface of which is flattened. Subgenital plate elongate, narrow, recurved, reaching much beyond cerci; dorsal surface longitudinally broadly and deeply sulcate between the decidedly thickened lateral margins; ventral surface medio-longitudinally carinate, this decided in all but third fifth. Apex of subgenital plate V-emarginate, the lateral apices each roundly swollen on their internal surfaces, these swellings touch and each has a rounded, soft area distad occupied with a microscopic node (a vestigial style?). In cross section the subgenital plate is almost flat mesad, but V-shaped distad. Cephalic femora with ventro-cephalic margins armed with (one or two) very minute black teeth, caudal femora with (five to six) larger black teeth on each ventral margin, those of the internal margin being the heavier.

Allotype.— ♀ ; same data as type, but taken July 26, 1924. [Hebard Collection.]

Agrees closely with male except in the larger size and more robust form. Very similar to the female sex of *taxodii*, except in the much larger size. Ovipositor long and broad, weakly curved dorsad, its vertical sides smooth, its dorsal and ventral margins armed with regular, rounded, microscopic teeth as in that species.[5]

General coloration light courge green, marked with whitish green as follows; head with a vertical band on face and an oblique bar below eyes, pronotal lateral lobes with broad ventral margins, pleura with flecks and a broad vertical bar mesad, abdomen with two longitudinal bands on each side and outer faces of caudal femora with a dorsal longitudinal streak. The lateral carinae of the pronotal disk are yellowish white and frequently there is a very fine whitish medio-longitudinal line on the occiput and disk of the pronotum. Tegmina light courge green; stridulating field of male cinnamon-buff, the stridulating vein darker (verona brown) and caudad of it a longitudinal suffusion of bister; anal field of female almost clear green, individually varying through cinnamon-buff to mikado brown, with two or three large blackish areas; median vein, stripe along juncture of discoidal and anal fields and distal portions of veins running to that margin, black; discoidal field usually with a whitish green streak adjacent to the median vein; marginal field transparent hyaline between the veinlets. Apices of wings light courge green, with exposed portion of median vein and apices of its branches also black. Eyes usually very dark, warm sepia. Antennae with

[5] In the series of *walkeri* the apices of the dorsal valves of the ovipositor surpass those of the ventral valves slightly or to a considerable degree. In the single female of *taxodii* known these apices are equal. These species may show an average difference in this feature, though it is probably of little diagnostic value.

two proximal joints light green, thence cinnamon-buff becoming darker distad. Limbs with spines and spurs black, auditory foramina flecked with blackish brown and caudal femora in intensively colored specimens flecked with the same. In the very few strongly intensive specimens before us, the pale as well as the dark markings stand out much more strikingly than is usual.

Measurements (in millimeters)

♂	Length of body	Length of pronotum	Caudal width of pronotal disk	Length of tegmen	Width of tegmen	Length of caudal femur
Waldo, Florida, *type*,	18.8	4.8	3.2	30.4	5	23.8
Waldo, Florida, *paratype*,	18.7	4.7	3.1	28	4.7	23.7
Waldo, Florida, *paratype*,	18.3	4.9	3.1	29.3	5	24.2
♀						
Waldo, Florida, *allotype*,	24.7	5.1	3.7	31.8	5.2	26.2
Waldo, Florida, *paratype*,	19.2	5	3.3	28	5.1	24.5
Waldo, Florida, *paratype*,	23.5	5.2	3.7	31.2	5.2	26.8

The large series shows little size variation.

Specimens Examined: 182; 55 males, 112 females and 15 immature individuals.

Florida: Sampson City, Bradford County, October 5, 1924, (O. Van Hyning), 3 ♂, 1 ♀. Waldo, Alachua County, July 18 to August 23, 1924, (F. W. Walker), 32 ♂, 60 ♀, 3 juv. ♂, 2 juv. ♀; September 23, 1924, (Walker and Hubbell), 6 ♂, 23 ♀, 3 large juv. ♀. Fairbanks, Alachua County, July 8 to August 5, 1924, (F. W. Walker), 9 ♂, 21 ♀; September 13, 1924, (F. W. Walker), 1 large juv. ♂, 3 large juv. ♀, 1 medium juv. ♀. Gainesville, Alachua County, July 21 and October 5, 1924, (F. W. Walker), 4 ♂, 4 ♀. Orlando, Orange County, September 4, 1924, (F. W. Walker), 1 ♂, 1 ♀, 1 juv. ♀. Kissimmee, September 10, 1917, (M. Hebard), 2 ♀, 2 juv. ♀.

The few specimens secured by the author were found on cypress shoots, in and on the edge of a small cypress "bay." Much work was required to locate these and a fruitless search was made nearby in several similar areas. Our notes state that, "the coloration blends perfectly with the foliage of the numerous half-withered cypress shoots."

We are informed that the Sampson City specimens were taken on cypress growing about the margins of a lake, while almost all secured by Walker and Hubbell were also found in the foliage of that tree, the few others being in adjacent vegetation.

Walker writes that, "during the day it is almost impossible to locate this species, as individuals conceal themselves in the thick foliage of the cypress, but at night they come out on the tips of the branches and can be located with the aid of a head flash-light. The majority were taken from small cypress trees and from sprouts around the stumps of cut cypress. All were found in trees or sprouts standing in water. None taken were very active, practically all being secured by hand, and where the trees were too high individuals could be brought within reach without alarming them by bending down the branches. The stridulation was rarely heard and was very low, similar to that of certain species of *Phaneroptera*, but much lower."

Hubbell records in his notes, "the song is rather low pitched and deliberate—zzzzzip——tk—tk-tk-tk-zzzzzzip——tk—tk—zzzzzip——tk——tk—tk—tk-tk-zzzzzip."

It is noteworthy that, though occurring adult as early as July 8, immature material is to be found as late as September 23rd. It is probable that the species, like others in the sub-tropical Floridian environment, becomes adult over a very much wider period during the year than is the case with most species in a colder climate.

All of the adults in this series are considered paratypes and belong to the Walker, Hebard and Hubbell Collections, but specimens will be distributed to the leading museums as well.

Inscudderia taxodii Caudell (Plate X, figure 1; plate XI, figures 6 to 9.)

1921. *Inscudderia taxodii* Caudell, Journ. Washington Acad. Sci., xi, p. 490, fig. 1, a to c. [♂ and juv. ♂; Durant, Mississippi; juv. ♂, Pickens, Mississippi.]

Due to the distortion of the original material, accurate description of the male genitalia was impossible. We here show these parts from well preserved specimens, giving the apex of the male subgenital plate in the extremes of our series, the apparently decided difference due largely to flattening of the lateral portions

in one, which in the other are almost vertical. In this species the genicular lobes of the caudal femora are bispinose, those of the other femora being blunt but each bearing a minute spine ventrad.

The previously unknown female agrees very closely with the males. It is slightly larger. The ovipositor is long and broad (as compared with that of the species of *Phaneroptera*), weakly curved dorsad, its vertical sides smooth, its dorsal and ventral margins armed with regular, rounded, microscopic teeth.[6] The female subgenital plate is small, triangular, with a percurrent median sulcation.

The measurements of our series are as follows: length of body, ♂, 14.4 to 16.5; ♀, 14.7: length of pronotum, ♂, 3.8 to 4; ♀, 4.2: caudal width of pronotal disk, ♂, 2.7 to 2.8; ♀, 2.8: length of tegmen, ♂, 23.1 to 23.3; ♀, 25.1: width of tegmen, ♂, 3.9 to 4; ♀, 3.9: length of caudal femur, ♂, 19.7 to 22.1; ♀, 22.3: length of ovipositor, 7.8 mm.

The species is yet known only from the originally described material and the series here recorded.

Specimens Examined: 13; 7 males, 1 female and 5 immature individuals. MISSISSIPPI: Greenville, September 14, 1915, (M. Hebard), 5 ♂, 1 ♀, 2 juv. ♂, 3 large juv. ♀.

This series was taken in a cypress slough, where the ground was heavily covered with *Polygonum punctatum* Ell. Individuals flew rapidly and were active in their movements. When at rest and motionless on the delicate *Polygonum*, they were virtually invisible.[7]

Inscudderia strigata (Scudder) (Plate X, figure 2; plate XI, figure 10.)

1898. *Scudderia laticauda* form *strigata* Scudder, Proc. Amer. Acad. Arts and Sci., XXXIII, p. 280, fig. 4. [Jacksonville, Florida.]

1914. *Scudderia strigata* Rehn and Hebard, Trans. Amer. Ent. Soc., XL, p. 289, pl. IX, figs. 6 and 13, pl. X, fig. 18.

In this species the ulnar vein of the tegmina is frequently offset at the juncture with the first branch of the median vein.

[6] Again more as in *P. septentrionalis* Serville than in the other species of *Phaneroptera*, though that insect shows the opposite extreme in width of tegmina and shortness of limbs.

[7] The foliage of the cypress was not at that time examined, as the insects appeared to inhabit the ground cover only.

The material now at hand shows this insect to be one of the most brilliantly colored and beautifully marked species of the Phaneropterinae. The caudal femora (missing in the originally described pair) are light green, often whitish ventrad, flecked with bone brown and suffused with that color distad, this often extensive and in intensively colored specimens continued to the base as a suffused medio-longitudinal external band.

Measurements (in millimeters)

♂	Length of body	Length of pronotum	Caudal width of pronotal disk	Length of tegmen	Width of tegmen	Length of caudal femur
DeFuniak Springs, Florida,	20	4.9	3	28.6	4.7	24.7
Grand Ridge, Florida,	18.5	4.7	2.8	27	4.4	24.5
Grand Ridge, Florida,	21	5.2	3.2	32.2	4.9	27.8
♀						
DeFuniak Springs, Florida,	19	5.2	3.2	31	5.1	26.5
Grand Ridge, Florida,	18.2	4.7	2.9	28.2	4.4	25.1
Grand Ridge, Florida,	22.8	5.4	3.3	34.1	5.2	30.3
Kissimmee, Florida,	21.2	5.6	3.6	34.2	5.4	29.3

The DeFuniak Springs series averages smallest, those from Kissimmee are largest, but considerable individual size variation occurs.

Rarely have we been more surprised and delighted in our field work than in the re-discovery of this splendid insect. It was first taken by Mr. Rehn and the author near water in the open, in a conspicuous fringe of the fine-leaved brushy plant, *Hypericum fasciculatum* Lam. Such environment is often to be seen, but search in the plant is frequently fruitless. The insect is so remarkably concealed in *Hypericum* during the day, that vigorous beating is the surest means of securing those present.

Specimens Examined, in addition to the originally described pair in the author's collection: 62; 14 males, 35 females and 13 immature individuals.

Florida: Grand Ridge, Jackson County, September 1, 1915, (Rehn and Hebard; perched in tops of low feathery-foliaged plants (*Hypericum fasciculatum* Lam.) margining wet depressions in the open, often many plants examined with no results), 8 ♂, 24 ♀, 7 large juv. ♀. DeFuniak Springs, Walton County, August 30, 1915, (Rehn and Hebard; occasional, beaten from *Hypericum fasciculatum* Lam., along streams), 6 ♂, 2 ♀, 6 large juv. ♀. Kissimmee, Osceola County, September 10, 1917, (Rehn and Hebard; beaten from cypress shoots in and on edge of cypress "bays", with *I. walkeri* here described but much more widely distributed, and also in *Hypericum fasciculatum* Lam.), 9 ♀.

Hubbell has kindly furnished the additional data, given below, on 170 specimens, including 107 males, 53 females and 10 immature individuals.

Georgia: Leslie, Sumter County, September 1, 1924, (H. L. Speer), 6 ♂, 5 ♀, 1 juv. ♀.

Florida: Cottondale, Jackson County, August 2, 1925, (T. H. Hubbell; on "Guinea Cypress" *Hypericum fasciculatum* Lam.), 2 ♂, 2 ♀. Waldo, Alachua County, July 13 to September 27, 1924, (Walker and Hubbell; cypress swamp margins, on *Hypericum fasciculatum* Lam.), 69 ♂, 27 ♀. Fairbanks, Alachua County, September 13, 1924, (T. H. Hubbell; on *Hypericum fasciculatum* Lam.), 3 ♂, 5 ♀. Gainesville, Alachua County, July 18 to October 5, 1924, (T. H. Hubbell; on *Hypericum fasciculatum* bushes, one male taken from young pine in middle of clump of these bushes, stridulating in the top bunch of needles, all but one of the immatures taken on first date), 19 ♂, 3 ♀, 3 juv. ♂, 6 juv. ♀. Orlando, Orange County, August 28 and September 7, 1924, (F. W. Walker; from *Hypericum fasciculatum* Lam., on edge of a cypress pond and from "Rosemary," *Ceratiola ericoides* Michx., growing around a small lake in the sand scrub), 6 ♂, 5 ♀. Taft, Orange County, September 4, 1924, (F. W. Walker; from *Hypericum fasciculatum* Lam., and sedges in cypress pond), 2 ♂, 6 ♀.

The following data on this species has also been furnished, through the kindness of F. W. Walker. "It is found in similar environment to the other insect (*I. walkeri*), but around the edges of the ponds on *Hypericum*. It also is strictly nocturnal, but individuals are far more active. The stridulation is much louder and heard more often at night."

EXPLANATION OF FIGURES

Plate X

Fig. 1.—*Inscudderia taxodii* Caudell. Male. Greenville, Mississippi. (× 1¾)

Fig. 2.—*Inscudderia strigata* Scudder. Male. DeFuniak Springs, Florida. (× 1¾)

Plate XI

Fig. 1.—*Inscudderia walkeri* new species. Male. *Type.* Waldo, Florida. Lateral view. (× 1½)

Fig. 2.—*Inscudderia walkeri* new species. Male. *Type.* Waldo, Florida. Dorsal view of ultimate abdominal tergite. (Much enlarged.)

Fig. 3.—*Inscudderia walkeri* new species. Male. *Type.* Waldo, Florida. Dorsal view of cercus. (Much enlarged.)

Fig. 4.—*Inscudderia walkeri* new species. Male. *Type.* Waldo, Florida. Ventral view of apex of subgenital plate. (Much enlarged.)

Fig. 5.—*Inscudderia walkeri* new species. Female. *Allotype.* Waldo, Florida. Lateral outline of ovipositor. (× 4)

Fig. 6.—*Inscudderia taxodii* Caudell. Male. Greenville, Mississippi. Dorsal view of ultimate abdominal tergite. (Much enlarged.)

Fig. 7.—*Inscudderia taxodii* Caudell. Male. Greenville, Mississippi. Dorsal view of cercus. (Much enlarged.)

Fig. 8.—*Inscudderia taxodii* Caudell. Male. Greenville, Mississippi. Ventral view of apex of subgenital plate. (Much enlarged.)

Fig. 9.—*Inscudderia taxodii* Caudell. Male. Greenville, Mississippi. Ventral view of apex of subgenital plate.[8] (Much enlarged.)

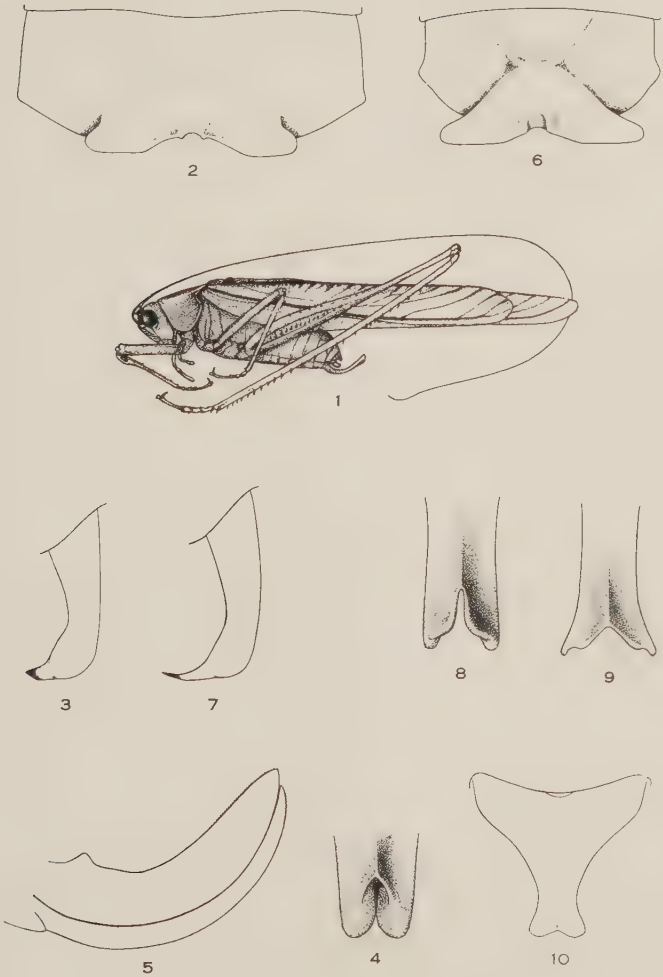
Fig. 10.—*Inscudderia strigata* (Scudder). Male. *Type.* Jacksonville, Florida. Dorsal view of ultimate abdominal tergite. (× 6)

[8] This specimen gives the usual appearance of the apex of this plate, as seen from below, for *taxodii*. Occasionally the lateral portions are more reflexed and sometimes are nearly vertical, as shown in figure 8.

1

2

HEBARD—GENUS INSCUDDERIA (ORTHOPTERA)



HEBARD—GENUS INSCUDDERIA (ORTHOPTERA)

A PRELIMINARY REPORT ON THE MORPHOLOGY OF THE AMERICAN DOG TICK

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Introduction

The work embodied in this report was conducted under the direction of Dr. Philip P. Calvert, of the Zoological Laboratory, University of Pennsylvania, to whose encouragement and kindly criticisms the writer wishes to acknowledge his indebtedness. One of the main difficulties encountered in conducting this study was in procuring live specimens, from which alone accurate dissections were possible. Numerous inquiries dispatched to friends and dog fanciers elicited interesting not to mention caustic comments, but very few dog ticks. After much effort about three dozen live specimens were obtained, upon the dissection of which, together with supplementary alcoholic material, the

results of the following pages are based. Some investigations were also attempted in the embryological, histological and bionomic aspects of this problem, but as the results were very meager they are left for a more thorough consideration at some future time.

The American dog tick, *Dermacentor variabilis* (Say, 1821) Banks, 1907, is reported from Canada, the Eastern and Central United States and Mexico. It is the *Ixodes variabilis* of Say, and Koch's *Dermacentor electus* is synonymous. In the Rocky Mountain States this species is replaced by *Dermacentor venustus* Banks, an important agent in the dissemination of the "Rocky Mountain Spotted Fever." The writer has personally collected *D. variabilis* in the vicinity of Philadelphia and near Lafayette, Indiana. A vial of several dozen ticks sent to the writer from the Canal Zone and collected on dogs by one of his former students, all proved to belong to the genus *Haemaphysalis*. It is doubtful, therefore, if the range of *D. variabilis* extends as far south as Panama. The adults of this species are commonly taken from dogs, whence the name, although not infrequently cattle, horses and human beings are also parasitized. Another popular name is the "wood tick," though very likely other species are included under this designation. Live specimens vary in color from a dark yellow to reddish brown depending, it seems, on the degree of engorgement. The male ticks are roughly oval in outline with the posterior end larger, and notched with slight indentations, forming the so called "festoons." Both sexes possess a dorsal shield of chitin, or scutum, which is ornamented in definite patterns by white spots, tactile hairs and depressions. The scutum extends over almost the entire dorsum in the males; in the females it is restricted to a small oval area adjacent and posterior to the capitulum. The females vary much in size and are invariably larger than the males. These variations are due primarily to differences in the degree of engorgement, a fully replete female becoming two or three times its original size.

Although the males do not become engorged like the females, there is a pronounced rotundity to the body of a male tick after feeding. This was determined as being due to lateral folds in the integument, between the scutum and the coxal segments.

These folds permit of a dorso-ventral expansion of the body, replete specimens showing a well rounded body much different from the distinctly flat bodies of unfed males. Unfed females show several longitudinal depressions on the dorsal surface, which partly disappear when they become engorged. These depressions are due to muscle bundles which connect the dorsal and ventral integuments. These muscles are found in both sexes, but are much more pronounced in the females. Besides the above, the body surface is irregularly marked with the very fine striae, characteristic of most Acarina.

Bionomics

Experiments conducted with living ticks yielded several rather interesting results. Of the thirty-eight that were obtained alive, seventeen died within three days, due possibly to injuries sustained when they were removed from the host. The remainder (twelve males and nine females) were kept in Petri plates on moist blotting paper, where they continued to live for varying lengths of time up to eighteen days. During this interval some of the males copulated with the females by crawling beneath them and appressing the ventral surfaces of their own bodies to those of the females. The genital apertures being thus brought into contact, a thick, viscid fluid was discharged which filled the space between the bodies of the two ticks, almost covering the male. This copulatory act was persisted in for different intervals, varying from several hours to five days. Possibly this last observation is in error, as the original male noted may have been replaced by others. When separated from the female, the male always showed a restless activity, wandering around until the female was found, when the act was repeated.

During July, five of the females oviposited masses of eggs which hatched out in twenty-five to thirty-two days. Incubation was effected at room temperature in Petri dishes. A very high mortality occurred among these eggs, due apparently to non-fertilization and to growth of molds. Plate 2, Figs. C–F, illustrate a few of the stages in development which were observed. One rather interesting fact was the sharp delineation of the malpighian tubules by the mold hyphae crowded into

them. These tubes were observed as early as the twelfth day of incubation, but were invisible unless brought out by molds or by staining. When oviposited, the eggs were of a light yellow color, oval, and possessed a waxy coat which made them highly impervious to most reagents and enabled them to float on water. In size they averaged .50 mm. × .36 mm. When measured after 20 days incubation the eggs were larger, averaging .56 mm. in length, and .37 mm. in width.

Table I

Measurements of Tick Eggs in 70% Alcohol

Eggs Newly Oviposited

Length	*Width*	*Length*	*Width*
.513 mm.	—.333 mm.	.504 mm.	—.360 mm.
.495 "	—.351 "	.504 "	—.342 "
.495 "	—.351 "	.495 "	—.315 "
.504 "	—.333 "	.495 "	—.351 "
.495 "	—.324 "	.495 "	—.315 "
.504 "	—.351 "	.513 "	—.333 "
.513 "	—.360 "	.495 "	—.387 "
.495 "	—.351 "	.513 "	—.342 "
.495 "	—.351 "	.522 "	—.360 "
.504 "	—.351 "	.513 "	—.360 "

Average of above—.503 mm. long, by .357 mm. wide.

Eggs After 20 Days, Incubation at Room Temperature (Approx. 25 C.)

In each case the first number denotes the length and the second number the width, expressed in millimeters.

.576—.405	.567—.405	.567—.378	.585—.378
.585—.414	.558—.396	.549—.405	.630—.423
.576—.414	.540—.378	.585—.396	.585—.360
.540—.387	.540—.378	.549—.378	.576—.360
.585—.378	.558—.414	.585—.378	.558—.360
.540—.360	.540—.405	.585—.369	.531—.387
.585—.414	.540—.378	.585—.360	.585—.378
.540—.360	.558—.405	.639—.423	.540—.342
.540—.369	.594—.405	.594—.378	.540—.351
.540—.360	.594—.414	.585—.387	.603—.378
.540—.360	.540—.360	.531—.360	.540—.369
.585—.396	.540—.387	.567—.396	.540—.360
.540—.369	.576—.360	.585—.378	.585—.378
.585—.378	.540—.360	.567—.378	.540—.378

.585—.387	.540—.387	.540—.360	.540—.360
.576—.378	.531—.360	.540—.387	.540—.378
.585—.387	.558—.378	.540—.378	.540—.360
.522—.360	.585—.387	.540—.378	.585—.387
.558—.387	.540—.378	.522—.378	.585—.387
.540—.360	.540—.378	.549—.378	.585—.378

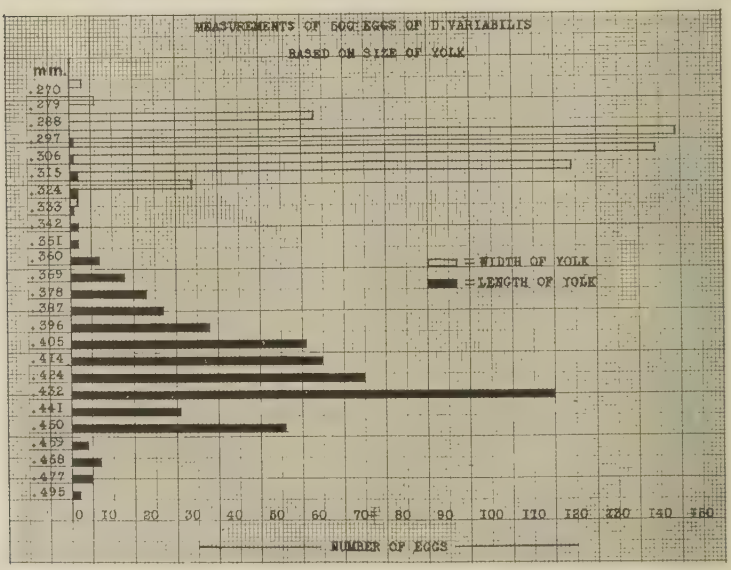
Average length—.562 mm.; average width—.375 mm.

The measurements upon which these averages are based are given in Table I. In every instance they were determined by means of a micrometer disk in the eyepiece of an 8× ocular, used in combination with a 16 mm. Spencer objective. Each division of the ocular disk, when calibrated with a stage micrometer, was found to possess a value of .009 mm. Multiply this constant by the number of graduations covering each egg, the values indicated in the above table were obtained.

When the measurements in Table I were plotted on graph paper, well defined bimodal polygons were obtained for the lengths and widths. As these eggs were all from a single female, their natural division into two groups was assumed as being due to differences in sex. To prove this assumption, ten of the small eggs and ten of the large eggs were isolated in separate vials and incubated at room temperature, which varied from 20 to 25 degrees Centigrade. Due to an accident, the vial of smaller eggs was broken toward the end of the experiment and the eggs were lost. The large eggs (over .6 mm. in length) completed their development, and from them hatched out four hexapod larvae one of which is shown entire in Plate I, Fig. B. Dissections were made of two of the other larvae and it was found that they possessed mandibular articles very similar to those of the females. These similarities are indicated in Plate III, Figs. B and J. Especial attention is directed to the dorsal process of the internal article, which is conical in shape like that of the female. Later dissection made on other larvae, showed some of them possessed of a slightly notched hypostome and a flat dorsal process, showing distinct resemblance to these same structures in the adult males.

From the above results it might be inferred that the larger eggs give rise to female ticks, and also that the sex of the larvae could be determined from a study of their mouth parts. These views are tentative, however, as the number of dissections per-

formed do not warrant a definite generalization. Due to the small number of both eggs and larvae which were available, they were used largely as whole mounts, from which, in turn, most of the observations and drawings were made. One of these observations was to prove or disprove the bimodal distribution of tick eggs. Five hundred eggs were measured in the manner already described, and the results are shown in the accompanying graph. These measurements were made from eggs cleared in xylol and mounted in balsam. As the outer envelopes showed considerable distortion; while the enclosed yolk was clearly defined, the measurements for the lengths and widths of the eggs were restricted to this yolk. In this case it was assumed that such shrinkage as had taken place would be proportional, and, if present, the bimodal distribution of the eggs should not be affected. The results, based on these shrunken eggs do not indicate the expected difference. In the graph, the ordinates indicate the lengths and widths in millimeters, while the abscissas denote the number of eggs in each class. The distribution of the lengths suggests a double mode, but the same is not pronounced enough to be of value. It is best, therefore, to



leave this matter in abeyance. However, the ascertained facts are included at this time as they may be of value to other workers.

The larvae mentioned in the above discussion were light yellow in color, and possessed of a relatively large, black, internal area in the region of the anus. The appearance of this area very early in the embryonic stage and its relation to the Malpighian tubules, indicates that it is a yolk sac which develops in the adult into the rectal diverticula. Several dissections of stained and unstained larvae, to determine the presence of spiracles and tracheal tubes, yielded negative results as regards the latter. There are, however, six spiracle-like openings, one posterior to each coxa.

The anterior pair of legs is infrequently used by ticks in walking. Their primary function seems to be olfactory and tactual. Whether at rest or in motion, or ascending vertical surfaces, the front legs are kept constantly in motion after the manner of the antennae of insects. When plegets of cotton, soaked in formaldehyde, ammonia and other volatile liquids, were placed in front of moving ticks, they would sense these substances at several inches and draw away from them. However, when a dog was confined near a glass dish containing ticks, they would all move toward the side on which the dog was confined, repeating this procedure when the dog's position was changed or the dish reversed. Throughout all these changes the front legs were continued in active movement, and appeared to be the chief factor in coordinating the actions of the ticks.

Technique

The dog tick proved a very refractory subject, no really satisfactory methods of investigation being developed. The chitinous integument was difficult to section, and, even when this was removed, insoluble, crystalline material in the intestinal diverticula made sectioning impossible. Attempts to dissolve out this material were unsuccessful, it being nsoluble in acids, alkalies and all the reagents that were used. Satisfactory dissections of the internal organs were possible only from fresh material. After several trials, a specific organ could usually be isolated from the other structures by dissecting a freshly killed tick in salt solution. The salivary glands, reproductive system and digestive tract were drawn from mounts prepared in this way.

Certain organs could be coordinated with a fair degree of success by staining the ticks with legs removed, dehydrating and clearing in xylol. Portions of the integument were then removed with dissecting needles, under a binocular microscope. The results of this procedure were at best uncertain, and are not to be recommended where living material is available. Still, where only preserved ticks can be had, the above method has some points in its favor. With patience and a certain amount of skill, acquired through experience, the internal structures can be worked out quite accurately. The tracheal system, mouth parts, malpighian tubules and other organs illustrated were determined by the above method. Various stains were tried but with indifferent results. To facilitate the staining process, various stains were mixed together and those combinations selected which yielded no precipitae. The object in this case was to devise a polychrome stain which would be transparent and at the same time would penetrate the chitinous integument of the tick. After several random selections, the following mixture was selected, and yielded some striking results. The salivary ducts especially, stood out with diagrammatic clearness even to their remote ramifications.

Iodine solution (saturated in 95% alcohol)	20 c.c.
Eosin (saturated in 95% alcohol)	10 c.c.
Delafield's Haematoxylin	10 c.c.
Picric acid (saturated in 95% alcohol)	5 c.c.
Alum Cochineal	10 c.c.
Glacial Acetic Acid	5 c.c.
Alcohol 50%	90 c.c.

The ticks were placed in the above mixture for about ten days, after which some were destained in acid alcohol, and others in alkaline alcohol. Entire mounts were prepared by clearing in xylol and mounting in balsam. The salivary ducts showed up in those ticks which were destained with acid alcohol. The ramifications of the tracheal tubes were best indicated in specimens destained with ammonia alcohol, their delineation being no doubt due to the precipitation of haematoxylin within them.

Although the above mixture gave some excellent results, it was by no means all sufficient. It was found, moreover, that

not every tick subject to this treatment gave the same results. For example, the entire salivary ducts were delineated in some ticks as shown in Fig. 1,B, while in others the delineation was imperfect or entirely wanting. These differences in response to the same reagents were doubtless due to the physiological state of the organs at the time that the ticks were killed. Thus, those specimens in which the salivary secretion was present in the ducts would react with the stain, while in others in which the secretion had not formed or had been discharged, no reaction would take place, and necessarily there would be no delineation of the ducts. Similar, fortuitous results were obtained in staining the Malpighian tubules and digestive tract, and for these the same explanation is offered. After clearing, those ticks that showed structures well differentiated were preserved as whole mounts; less perfect specimens were dissected in xylol under the binocular microscope, as already described.

Specific Diagnosis

Male: Length of body exclusive of capitulum, 3.5 to 5 mm.; width at spiracles, 2 to 3 mm.; body oval and narrower at anterior end; color light chestnut to chocolate brown in replete specimens; legs and capitulum lighter. Dorsum: Eyes in region of coxa II, lateral and prominent. Scutum ornate with white dots, depressions and tactile hairs. The white markings are in the form of two wide, parallel, submarginal lines, which extend straight back from the lateral grooves to coxa IV. Each of these lines then bends at an obtuse angle toward the body margin, and terminates just posterior of the spiracle. Another thinner, W-shaped line connects posteriorly with the above angles, its basal loops reaching to the median festoons. Additional white markings extend outward from the lateral lines and are continued for some distance along the dorsal surfaces of the legs. Pseudoscutum prominent; lateral and cervical grooves distinct; pulvilli large, oval, and placed between two claws; tarsi of first legs armed with a single conical, disto-ventral spur, and numerous stout, tactile hairs; Haller's organ, dorsal and prominent; tarsi of other legs with two spurs. Fovea, sub-spherical situated between angles of lateral ornations. Capitulum: Dorsal surface of basis capituli flat with prominent, postero-lateral projections; ventral surface convex and without projections. Width of capitulum one-half to three-fourths the length. Dorsal process of internal article of mandible flat, triangular shaped; external article with two teeth. Hypostome ventral, with six rows of

teeth, and prominent notched corona. Palps slightly longer than mouth parts; four segmented; first and second segments fused; fourth segment least in size, and contained in an oval depression in the third segment; proximal border concave; dorsal surfaces wider than ventral; second and third segments about equal in size and largest. Venter; Anal groove indistinct, and curved behind the anus. Coxae progressively larger, coxa IV being the largest; all coxae with a single posterior spur, except coxa I, which is deeply bidentate. Posterior legs longer than other legs. Stigmal plates are situated just posterior of coxa IV, sub-oval; anterior margin smaller; postero-dorsal margin raised and bluntly pointed. Genital aperture narrow, oval, and situated between second pair of coxae.

Female: Length of body, 4 to 11 mm.; width at middle of body, 2.5 to 7 mm. Color generally darker than that of male, chestnut brown to chocolate in alcoholic specimens; a decided yellow on dorsum in living specimens. Dorsum: Scutum oval, about one and one-half times as long as broad; white; with a wedge shaped median, brown cleft which extends almost to the posterior border. At the side of this central wedge are two brown, lateral lines, which bend at an obtuse angle at about their middle, the whole structure making a decided M. Within and at the base of each of these diverging lateral lines there are two large, brown dots which run tandem to each other. These we shall designate as the median punctations. Opposite the angles made by the lateral lines, about half way between them and the scutal margins, there are other brown dots, four on each side, the anterior one being the smallest. These may be designated as lateral punctations. At the posterior margins of the scutum, between each set of median and lateral punctations, there are four other dots, two on each side. Besides these large dots which average .046 mm. in diameter, there are many minute dots, ridges and tactile hairs. The scutal markings are somewhat variable, but the characteristics described seem to be constant for this species. Eyes simple; at the middle and lateral margins of scutum. Fovea lateral, round and about .10 mm. in diameter, situated on dorsum midway between the anterior margins of the stigmata. Festoons eleven; prominent in young females; indistinct in replete females. Venter: Legs with pulvilli, each with two claws; last pair of legs longer than the others; anterior legs with Haller's organ on dorsal surface of tarsal segments; the dorsal surfaces are also ornamented with white markings, but not as pronounced as in male. Tarsi of first legs without a terminal conical spur; tarsi of other legs with a single spur. All coxae approximately equal, with coxa IV slightly larger. Coxa I with two long spurs; remaining coxae with a single postero-median spur. Genital aperture ventral, between second pair of coxae; wide, cone-shaped in

young females; a narrow oval slit in gravid females. Anus: A ring of chitin averaging .34 mm. in diameter with anterior border thicker. Within this are located two laterally-moving valves which protrude ventrally. Capitulum: Same general shape as in male. Dorsal surface flat with prominent, postero-lateral projections. Porose areas prominent, situated on dorsal surface of basis capituli, between the mandibles and palps, sub-oval to crescentic, with posterior margin convex, average width, .01 mm. Ventral surface convex, without projections. Hypostome with six rows of teeth on ventral surface; corona inconspicuous, anterior margin straight and with only a small median notch. Dorsal process of internal article conical. External article flat, and with three teeth.

Nymph: (Plate I, A.) The following description is based on five similar specimens captured on dogs and assumed to be the species in question. Body a long oval, tapering cephalad abruptly at coxa IV and forming with the capitulum a distinct angle; length, 2 to 2.5 mm.; width at spiracles, 1.3 to 1.5 mm.; color (in alcohol) light chestnut brown. Capitulum: Basic capituli convex at body margin; concave at sides; dorsal surface with a lateral projection on each side which, with the mouth parts, form a distinct triangle. Hypostome short, with a few large terminal teeth. Mandibles cylindrical rods of chitin with distal ends rounded and .04 mm. wide; length, .4 mm.; denticles of mandibular sheath prominent, articles not determined. Palps of same general structure as in adults; four segmented; no hollow ventral spines; length, .23 mm.; first segment, .04 mm. wide at insertion into basis capituli, width at junction of second and third segments, .11 mm. A broad, dark-brown, saddle shaped ridge of chitin is situated at anterior margin of basis capituli, between each mandible and adjoining palp. Dorsum: Inornate; median and lateral muscle bundles prominent. Fovea not visible. Festoons missing. An internal, oval brain mass is visible in cleared specimens; situated between coxae II and III. Venter: Legs eight in number, and of approximately the same length; Haller's organ prominent on first tarsi; pseudo-articulations occur on all femora, and on tarsi of last three pairs of legs, proximal margins of coxae I and II angular; of other coxae convex. Coxae I each with a single long spur at proximal, posterior angle; remaining coxae each with a narrow, ventral spur at junction of trochanters. Spiracles oval; .16 mm. long and .11 mm. wide; situated one on each side, about .4 mm. posteriorly of coxa IV. Anus almost circular; on mid-ventral line about .55 mm. from posterior body margin; structure same as in adult; length .11 mm.; width .10 mm. Porose areas: on posterior half of basis capituli; .25 by .15 mm.; dorsal; prominent; .09 mm. apart; lateral length longest.

Larva: (Plate I, B.) Body somewhat circular; color yellowish brown, with a large internal, median, black spot in the region of the anus. Length of body, .55 to .60 mm.; width at coxae IV, .45 to .50 mm. Capitulum distinctly triangular, if palps are not considered, lateral processes of basis capituli prominent; palps .11 mm. long, .035 mm. broad at middle; fourth segment protrudes from cavity and is armed with about ten tactile hairs on its free surface; ventral hollow spines missing. Hypostome a single, spatulate piece of chitin, with four rows of large teeth; five teeth to each row. Mandibles .1 mm. long and .02 mm. wide; distal surfaces rounded, and armed with large recurving denticles. Articles of same structure as in adults; of possible diagnostic value in determining the sex of larvae. Dorsum: Scutum indistinct, not determined. In stained specimens, there is visible a large, internal, pyramidal mass in the anterior two-thirds of the body. Posterior to this there is another oval, black mass, the yolk sac. Between these two there are situated laterally, two small, dark areas, one on each side. From their position, they appear to be the anlage of the fourth pair of legs. Festoons not prominent; nine in number. Fovea not visible. Venter: Legs six in number; six segmented; Haller's organ prominent on first tarsi; pulvilli large and with two claws; first coxae with a single large spur on posterior margin; second coxa with a smaller spur; no spur on third coxae, all femora and tarsi of legs II and III, with pseudo-articulations; first pair of legs the longest. Spiracles six in number, located one posterior of each coxa. Three muscle bundles extend posteriorly from the anal region to body margin. Anus median, circular, .05 mm. in diameter; same structure as in adults; situated .45 mm. from posterior body margin.

Anatomy of the Adult

the capitulum

The mouth parts and palps articulate with the body by means of a basal portion, the basis capituli; together these structures form the capitulum (Plate III, Figs. C and H). The basis capituli is roughly oval in cross section, and fits into a concavity in the cephalothorax of which last it forms a part. Laterally, on its dorsal margin, there are two backward protruding angles of chitin, the cornua, which effectively prevent movements of the capitulum above the dorsal plane of the body. On each side of the basis capituli, extending almost to its distal edge, there is a triangular, dorsal projection of the cephalothorax, the scapula. By these last and the cornua, the capitulum is restricted to an

up and down movement from a horizontal body plane ventrad to a position almost at right angles to the body.

The basis capituli of both sexes is flattened on its dorsal surface, and convex on its ventral surface, the convexity being due to the accommodation of the mandibles and the buccal cavity. The floor of the basis capituli is prolonged anteriorly into an immovable, spatulate structure, the hypostome. This last is broadest at its distal end, and concave on its dorsal surface. Along the whole length of this concavity runs a deep, median groove, the vomer, which permits the hypostome being split readily into two symmetric halves. The distal extremity is sharp, flattened, and possessed of very small, closely crowded teeth, which, because of their appearance, are designated collectively, the corona. The hypostomes of both sexes (Plate III, Figs. D and E), are armed with six rows of large, backward-pointing teeth. These occur only on the ventral surface, and approximate ten to a row. Measurements made of the hypostomes of twenty male and twenty female ticks, averaged respectively .46 by .15 mm., and .55 by .18 mm. In each instance, the smaller number represents the width of the hypostome obtained by measuring its extremity at the corona.

Lying directly above and in close apposition to the hypostome, are two structures, the mandibles (Plate III, Fig. C). These are cylindrical tubes of chitin, armed at their distal ends by the digits, and invested externally by the mandibular sheaths. Each mandible is situated a little to one side of the median line of the body, so that when their inner edges come together, they lie above and parallel with the vomer of the hypostome. Internally, the mandibles are hollow, the cavity of each being occupied chiefly by a set of flexor and extensor muscles. These last are striated, and of the usual arthropod type. They arise from the lateral walls of the mandibles, traversing the same as parallel muscle bundles for almost their entire lengths. Distally, each set of muscles terminates in a single tendon, which is inserted into, and serves to move the digit on the same side. Each mandible also contains a pair of tracheal tubes, and a nerve from the anterior primary ganglion located in the cephalothorax. The proximal ends of the mandible traverse the entire basis capituli, extending for some distance into the cephalothorax. These ends

are enlarged club-shaped and perforated for the entrance of the nerves and tracheae. When torn away from the body, the mandibles invariably show long muscle fibers protruding from their proximal openings. In both sexes these fibers can be traced to their origin in the dorsal hypodermis, in females, at the posterior margin of the scutum, and in males along the margin of the so called "false-scutum." These last form a part of the retractors of the mandibles.

The mandibular sheaths are immovable structures, derived as prolongations from the antero-dorsal surface of the basis capituli. They occur in all stages of development, and are armed externally by backward-directed scales, the denticles. A separate sheath invests each mandible. At their distal margins these sheaths become fused with the membranous, non-denticulate sheaths of the digits. These last are attached to the basal portions of the digits, and because of their flexibility, permit of free movements of the mandibles. The mandibles are therefore capable of being extruded or withdrawn to the full length of these inner membranes, which, for convenience, will be designated as the digital sheaths. The denticles (Plate III, Figs. F and G) differ in size and shape in different regions, being long and narrow at the distal ends, and relatively short and stout as they approach the proximal margins of the mandibular sheaths. Individually, they consist of a basal piece of chitin imbedded in the thinner integument, and from the antero-median region of each there arises a backward-directed, triangular projection. In ticks removed from the host these projections are imperfect or broken off entirely, in such cases the denticles show a median, triangular depression. These differences are clearly shown in the accompanying diagram.

The digits (Plate III, Figs. I and J) deserve some consideration as they differ markedly in the two sexes. In the male, the dorsal process of the internal article is serrate and wedge-shaped. In the female this same structure assumes the form of a single conical process, which fits into a definite concavity and is easily broken off. The external articles of the males are bidentate; those of the females tridentate. Internally, the articles are hollow, containing relatively large ducts which open to the exterior by pores. A secretion must undoubtedly pass through

these ducts and pores to the exterior but its source and nature have not been determined. The salivary gland ducts terminate in the buccal cavity, and seemingly have no connection with the mandibles. The secretion of the mandibles must therefore come from another source, very likely from the coxal glands. This last is merely a supposition and remains to be proved. As already indicated, the articles are of value also in determining the sex of the larvae and nymphs. In Plate III, Figs. A and B, are shown the mouthparts of a newly hatched larval tick. The conical dorsal process, and general structure are very similar to these same organs in the female tick. The hypostome (Fig. A) has a distinctly flat, distal margin, which is also a characteristic of the female hypostome. In other larvae these same structures were found to be different; namely, the dorsal process and the hypostome assumed more nearly the appearance of these parts in the male tick.

The basis capituli varies from oval to almost rectangular in cross section. In males it averages .63 to .32 mm.; in females .73 and .32 mm. The first figures, in each instance, represent the extreme width taken on the dorsal surface, and are based on averages of ten different measurements. The second figures denote the average length, obtained by measuring from the insertion of the palps to the tips of the cornua. The cornua were broader and slightly longer in the males. In length, they averaged .06 mm. and .04 mm. respectively. The ventral surfaces of the basis capituli are concave and longer, in both sexes, than the corresponding dorsal surfaces. Two porose areas are to be found on the dorsal surface of the female basis capituli. They are oval to crescentic, prominent, and average .01 mm. in diameter. When examined under the high power of the microscope, each porose area presents a shallow concavity from which arise short, nipple-like processes, each opening in a pore. The function of these structures was not determined.

The last capitular appendages to be considered are the palps (Plate II, Fig. B). These are broad, club-shaped organs, consisting of four segments in both sexes. The first or proximal, and the fourth segments are the smallest. The last is inserted into a cavity near the antero-ventral margins of the third segment. It may be extruded or withdrawn, possesses a tuft of hairs at the

apex and is apparently tactual in function. Measurements made from balsam mounts of the palps of ten male and ten female ticks, gave lengths of .55 mm. and .70 mm. respectively. The second and third segments of the palps are deeply concave, and broader on their dorsal surface. The second segment is the largest, averaging in width in the females, .32 mm. on its dorsal and .22 mm. on its ventral surface. In males, these same palpal segments are correspondingly smaller, averaging in width .31 and .21 mm. on the dorsal and ventral surfaces, respectively. The peculiar structure of the palps permits them to invest closely the mandibles and hypostome, from which fact it may be deduced that their function is primarily a protective one. Besides these main characteristics, a few additional points deserve mention. The first and second segments are fused. Externally, the palps are covered with irregularly placed, tactile spines. Along the ventral edge of the first and second segments are long, stout spines which are hollow, and which communicate with the interior of the palp by means of ducts. In several ticks these spines were found deeply buried in the dermal tissue which was torn away when the tick was removed from the host. The specific function of these spines was not determined. They may possibly serve to inject a secretion into the host's skin at the site of the bite.

THE SALIVARY GLANDS AND DUCTS

The salivary glands (Plate II, Fig. A) are two long, racemose glands, located one on each side of the body. They extend, in both sexes, from the buccal cavity to the posterior borders of the stigmatal plates. The drawing for the above illustration was made to scale, from a prepared balsam mount, and represents the salivary glands of an engorged female. In this condition they measured 3.7 mm. in length and .96 mm. in width. Fresh dissections, in salt solution, of the glands of four males gave measurements which averaged 2.5 mm. in length and .6 mm. in width. The ratio of length to width (4 : 1), seems to be typical of this species, as a total of eleven different measurements approximated this ratio very closely. The units of structure, of these glands, are globular alveoli which average .065 mm. in diameter. Each alveolus is composed of some 10 to 12 large

nucleated cells arranged about a central cavity. This cavity (.01 to .02 mm. in diameter) communicates with a small alveolar duct which, with others, unites to form relatively short lobular ducts. These, in most cases, unite directly with the common duct of the gland. For this reason the alveoli are closely appressed to the common duct, and it is difficult to make out this last unless special methods are used. Fortunately, it is quite easy by selective staining to bring out these ducts. The males show these structures clearly when the whole tick is stained, cleared and mounted in balsam. When thus prepared, the ramification of the ducts and their relation to other organs in the body can be readily determined.

The ducts (Fig. I, A and B) show a fairly uniform diameter of .02 mm. Anteriorly they are inserted into the buccal cavity, entering the same from the side and below the mandibles. If the mandibles are extended, which process involves the raising of the buccal cavity, the salivary ducts become stretched and fairly straight. If, however, the buccal cavity is depressed, the anterior portions of the salivary ducts become curved in a fairly constant and characteristic manner. These changes, together with the ramifications of the ducts, are indicated in the accompanying illustrations. In Fig. I, B, the two salivary ducts are shown in place from the dorsal aspect. The right duct shows quite accurately the distribution of the smaller branches. In the left duct these branches have been omitted so that they do not obscure the convolutions of the Malpighian tubule. It is to be noted that, with one exception, the branches are very short between the first and fourth coxae, making together an elongate, compact lobe. Posteriorly, at about the center of coxa IV, each main duct divides to form two lateral ducts the inner of which is longer and extends to the posterior margin of the stigmatal plate. These lobar ducts average .01 mm. in diameter, and like the main duct have short lobular branches. The two posterior lobes, thus formed, are bound together by a plexus of tracheal tubes, and the entire gland is surrounded by the lateral and posterior diverticula of the digestive tract.

The walls of the main ducts are quite thin, and composed of two layers. In their structure and manner of branching they resemble rather closely the tracheal tubes. As in the latter,

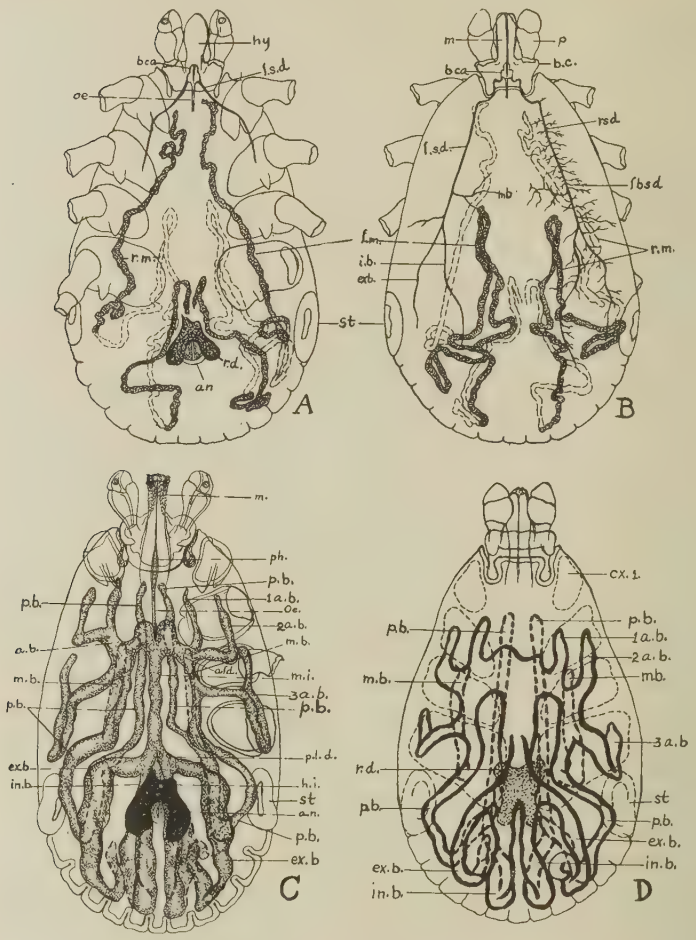


Figure 1. A. Ventral aspect of male tick, showing parts of Malpighian tubules proximal to the ventral integument, and appearance of salivary ducts when the capitulum is raised. × 12. B. Dorsal aspect of same tick; showing those parts of Malpighian tubules proximal to the dorsal integument, and also the right and left salivary ducts. The insertion of these ducts into the buccal cavity and their characteristic curved appearance when the capitulum is depressed are also shown. Drawn from stained balsam mounts of whole ticks. × 12. C. Intestinal diverticula of partly engorged female in dorsal aspect; drawn from an unstained balsam mount, and designed to show the relation of the diverticula to each other and to the coxae. × 12. D. Intestinal diverticula of partly engorged male in dorsal aspect; drawn from an unstained balsam mount. × 12.

there is a thin inner layer of chitin distributed in grooves and annulations. However, this layer is not composed of continuous spiral threads, but assumes the form of thickened chitinous folds at right angles to the long axis of the ducts. These folds or ridges may or may not form complete rings. They are less pronounced in the smaller branches and barely perceptible in the alveolar ducts. They are, moreover, easily broken, of unequal thickness and irregularly spaced. Investing this inner layer, which averages .005 mm. in thickness in the large ducts, is a layer of lightly staining cuboidal cells .008 mm. thick.

The alveoli have already been mentioned, but deserve some additional comment. There are present two different kinds of alveoli, which appear to be restricted to separate lobes. About one-third of the alveoli average .06 mm. in diameter, and have very large, deeply staining nuclei. The other alveoli are larger, averaging .07 mm. in diameter, but possess smaller, lightly staining nuclei. The average diameter of the large nuclei is .015 mm., that of the smaller .009 mm. The deeply staining nuclei also show greater variation in size, ranging from .008 to .02 mm. in diameter, and these variations may occur within the same alveolus.

These morphological peculiarities would suggest differences in function. One or two experiments were attempted to determine this possibility, but as the material was insufficient and the results not conclusive, this phase of the problem is reserved for a later discussion.

THE ALIMENTARY TRACT

The alimentary tract of the dog tick (Plate II, J and Fig. I, C, D) consists of a number of blind pouches or diverticula, which communicate with the mouth by means of an esophagus and a mid-intestine. Beginning with the buccal cavity, the external opening of which forms the mouth, the following parts can be distinguished in the course of the alimentary tract:—pharynx; esophagus; anterior intestinal diverticula; mid-intestine; posterior intestinal diverticula; hind-intestine; rectum; rectal diverticula and anus. The descriptions which follow are based largely on the dissections of freshly killed female ticks in salt solution. The alimentary tracts of larval, and nymphal stages

were but imperfectly determined, and will be left for a more thorough discussion in a later report.

The buccal cavity is situated in the anterior part of the basis capituli, between the palps. Its roof is formed by the mandibular sheaths, and its floor and sides by the concave hypostome. Posteriorly, it merges into the triangular, funnel-like pharynx, which opens into its floor, by a slit-like aperture. A salivary duct also opens on each postero-lateral margin of the buccal cavity, the salivary secretion being conveyed, from this last, into the wound by means of the vomer of the hypostome. The greater portion of the basis capituli is filled with muscle fibers which attach to the pharynx, buccal cavity, and the mandibles. By their means the buccal cavity is apparently capable of being raised and lowered, if not actually modified in shape. Several slides (in which the salivary ducts are brought out very clearly) show differences in shape of the buccal cavity and straightening of the salivary ducts, which can be explained only on the assumption, that the buccal cavity undergoes changes in shape or position. These differences are brought out in Fig. I, A and B.

The pharynx is an irregularly, funnel-shaped chitinized tube, extending from the floor of the buccal cavity, to the postero-ventral margin of the basis capituli. In its main parts it agrees closely with the description of this same organ in other members of the Ixodoidea. It is chitinous throughout, being thicker and wider at its anterior end. In cross section, the middle part shows usually two lateral folds or concavities, with a deeper, narrower concavity on its dorsal and ventral surface. Externally, there are attached to it numerous muscle fibers, which arise from the hypodermis of the basis capituli. The lateral muscles are the longest and they fit into the concavities already mentioned. The alternate expansion and contraction of these different muscles, produce a pumping action which doubtless aids in the ingestion of blood. Dissections made of five female ticks gave an average length of .45 mm. for this structure.

The esophagus is a delicate tube which begins at the pharynx, and runs through, and a short distance behind, the brain. In one prepared mount, in which this organ is isolated and adheres to the brain, the length is 1.6 mm. and the average width .04 mm. The same slide shows several nerves running from the brain

parallel to the esophagus, the whole invested by a wide membranous sheath. About midway between the basis capituli and the brain, this sheath is .09 mm. wide, and consists of a single layer of squamous epithelium. It is also continuous with the sheath which invests the brain. The lumen of the esophagus is very small averaging .009 mm. in diameter. On cross section, there appears a layer of irregular, cuboidal epithelium, invested by an outer, thinner, less distinct layer of cells. The minute histological structure of this and other organs will be considered in a later report.

The mid-intestine and its diverticula comprise the main part of the alimentary tract. The drawing for Plate II, Fig. J, was made to scale, from a fresh specimen dissected out in salt solution, and represents these structures as they appeared in a fully engorged female tick. The mid-intestine is a relatively short stout tube, possessing in this instance, a length of 7 mm., and an average width of 1.5 mm. Anteriorly it divides to form two antero-lateral diverticula, each with five branches. These branches are blind tubes, of irregular diameter, and show a progressive elongation, the most distant ones being the longest. For convenience, these will be designated as the anterior, median and posterior branches of the antero-lateral diverticulum. On each side of the esophagus, which enters the mid-intestine at its anterior extremity, are three anterior branches labelled respectively 1, 2, and 3 in the drawing. The first two run straight forward beneath the dorsal integument; branch 2 to the posterior margin of coxa I, branch 1 to about the anterior border of the brain. The third branch extends laterally to the outer margin of coxa III, where it makes an abrupt right-angled turn cephalad and ends blindly at the anterior margin of coxa II. The fourth or median branch of each antero-lateral diverticulum, follows a more complicated course. It first dips ventrad at the posterior margin of coxa IV, paralleling the salivary gland on the same side. It then makes a right-angled turn, running cephalad, and ending blindly at the posterior margin of coxa II. It is thus closely appressed to the salivary gland and attached to the same by means of an extensive network of fine tracheal tubes. The posterior branch of each antero-lateral diverticulum runs back to the region of the third festoon (counting from the stigmatal

plate), then dips ventrad and runs along the ventral surface of the body, paralleling the mid-intestine, and ending blindly just posterior to the mandible. Within the folds thus formed are included the convoluted lobes of the reproductive system.

The posterior diverticulum is less complicated, dividing twice, dichotomously, into four long branches, two of which are located on each side of the body. It arises on the dorsal surface of the mid-intestine, about 2 mm. from its anterior bifurcation. The anterior and posterior diverticula arise, therefore, in close proximity to each other. The posterior diverticulum is about 1 mm. in length and width. It then divides to form a right and left branch, each about 2 mm. long. Each of these, in turn, produces an internal and an external branch, averaging 25 mm. in length in the female. The four branches thus formed run caudad to the region of the festoons, where they dip ventrally and retrace their course along the ventral surface, their blind ends terminating in region of the rectal diverticula. In this manner the anterior portions of the four branches are situated above the mid-intestine, while their terminal portions run along the ventral hypodermis, underneath the ovary. Externally the intestinal diverticula are invested by a fine network of tracheal tubes, which penetrate into and between the different branches, making isolation of the same very difficult. When the integument of a tick, hardened in alcohol, is dissected away, the different branches of the alimentary tract are seen to parallel each other longitudinally on both dorsal and ventral surfaces. In the grooves formed between them, the Malpighian tubules are distributed and appear as yellowish-white cords. If care is exercised to remove the brain, the same will appear as a small rounded mass at the anterior bifurcation of the mid-intestine. The ramifications of the different branches, together with their approximate position in relation to the coxae and festoons, is shown in Fig. I, C and D. The former figure illustrates the female, and the latter, the male alimentary tract. Both of these drawings were made to scale from prepared balsam mounts, and show the relationship of the parts quite accurately. Except as to smaller size, and less pronounced lobate appearance of the rectal diverticula, the above description can apply also to the alimentary tract of the male. However, it is possible that minor differences may be present, as

determinations, in the case of the male, were made almost exclusively from whole mounts.

The mid-intestine connects with the rectum (the cloaca of some authors) by means of a very short hind-intestine. This last averages 1 mm. in length, and at the junction of it and the rectum are the openings of the Malpighian tubules. The rectum is a delicate, mebranous sac, shaped somewhat like a flask, the neck of which opens between the lateral valves of the anus. Its antero-lateral borders give rise to two crescent-shaped diverticula, which run caudad on the outside of the muscles working the anal valves. These diverticula are filled with the same secretion as the rest of the digestive tract, and stand out clearly as two recurving pouches around the anus. (Plate II, Fig. H; and Fig. II, A, C, D.) The size of the different parts of the alimentary tract varies widely, depending on the degree of engorgement. Certain caeca which showed a width of 1 mm. in one specimen, might show a width of 3 or 4 mm., at the same place, in another specimen.

The contents of the intestinal caeca appeared to be mainly blood mixed with digestive ferments. In freshly engorged ticks the erythrocytes appeared intact. However, after several hours digestion they were reduced to a sticky, reddish-black mass, within which could be distinguished two organized elements; namely, large, black, amoeboid cells, and the elongate crystals already mentioned. The cells could be observed in motion in warm salt solution, and averaged .025 mm. in diameter. They occurred free in the lumen of all the intestinal caeca, and judging by their number and the fact that their pigmentation was due to ingested haemoglobin, they must be important agents in carrying on the digestive function. A strong peristalsis was also observed in partly replete ticks of both sexes. These movements averaged seven a minute and occurred in both the mid-intestine and its branches, their course being usually from the terminus to the origin of the diverticula. Reverse movements, although infrequent, were also observed.

MALPIGHIAN TUBULES

The Malpighian tubules (Fig. I, A and B) comprise a part of the excretory system of the tick, and have been ascertained with

some degree of accuracy. They are long, unbranched tubules, white in color and vary considerably in their diameter. There are two of these tubules in both sexes, and although their course is a rather tortuous one, they are not very difficult to follow in fresh dissections. Arising ventrally, as blind tubes close to the basis capituli, they run posteriorly at the proximal margins of the first and second coxae. They then bend laterad and continue their course just over the muscles of the third and fourth coxae, and at about their center. Reaching the region of the stigmata, each tubule describes a loop around the tracheal tubes on its side; then runs dorsad and forward on the dorsal surface, extending to the anterior margins of the third coxae. In this region they bend sharply on themselves, and again run caudad, this time extending to the posterior margin of the body, about .6 mm. on each side of the median line. In this dorsal position, they lie between the external and internal branches of the posterior diverticula, one on each side. Having reached this body margin, both tubules bend dorsad, and continue forward on the ventral surface. Here they come to lie, one on each side, between the mid-intestine and the internal branches of the posterior diverticulum. In this, their final course, the tubules extend forward to about .5 mm. in front of the anus, double back once more in their course, and terminate at the junction of the hind intestine and the rectum.

The secretion of these tubules is a sticky, emulsive substance, white in color, and resembles globules of fat under the microscope. These globules differ in size, and it is their presence which gives to the tubules their white color. Just how this material is elaborated was not determined. It was observed, however, that the excretion of ticks confined in a Petri plate consisted almost entirely of this substance. On the other hand, examination of the excreta of ticks for the crystalline material present in the alimentary tract yielded negative results. It appears, therefore, that the intestinal contents are thoroughly digested, and only such material is excreted as is taken up by the Malpighian tubules. These last open into the hind-intestine, at its junction with the rectum, and their contents are discharged through the anus.

In fresh dissections the tubules are found to be closely invested with a net work of tracheae. These being stronger, make isolation of the former rather difficult. The stretching attendant on their isolation makes the Malpighian tubules considerably longer than their normal length. A pair of male and female tubules isolated in this manner gave lengths of 28 and 62 mm., respectively. The width of these tubules varied considerably, depending on the degree of distention. As a rule it ranged from .1 to .5 mm. Upon section these tubules show a single layer of low columnar cells which average .025 mm. in diameter. In the distended areas the cells are flattened considerably, and resemble simple squamous epithelium. The nuclei are large, deeply staining and show coarse refractive granules. In Figure I are shown the dorsal and ventral aspects of these tubules in a male tick. The drawing was made to scale from a stained specimen mounted in balsam. Figures A and B are supposed to be complements of each other. In A we have the ventral aspect of these tubules, and the shaded areas represent those portions which lie in the focal plane of the microscope when viewed from the ventral surface. The dotted portions indicate those parts which are situated on the dorsal surface. Conversely, in Figure I, B we have the dorsal aspect of the same tick. The shaded portions of the tubules in B are the same as the dotted portions A, and vice versa.

THE REPRODUCTIVE SYSTEM

The reproductive system of the female (Plate II, Fig. G) is essentially a closed, somewhat convoluted tube, the ends of which unite in a common aperture on the dorsal surface of the uterus. Beginning with the external genital aperture the following parts can be distinguished; vagina, accessory vaginal glands, uterus, seminal receptacles, oviducts and ovary. Since there is a marked difference between gravid and non-gravid uteri, their chief characteristics will be described separately.

That portion of the reproductive tract between the vulva and uterus is designated as the vagina. It lies closely appressed to the ventral hypodermis, and into it open two horn-shaped accessory glands, the free ends of which curve cephalad. The function of these glands is not entirely known, but the writer

thinks that they take part in secreting the viscid fluid which is found between the closely appressed bodies of ticks in copulation. It was observed that when copulating ticks were separated, and the secretion was wiped off a female, that it continued to ooze out of the genital aperture. In the specimen from which the above drawing was made, only one of these glands remained attached, its size being .8 mm. by .3 mm. The cells of these glands are irregularly columnar in shape, deeply staining; about .05 mm. long and with large nuclei averaging .02 mm. in diameter. The vaginal wall consists of both connective tissue and striated muscle fibers. The size of this organ seems to vary, but averaged .42 mm. long by .15 mm. wide in three specimens which were measured from prepared balsam mounts. The vagina communicates with the exterior by means of a chitinous, U-shaped aperture, the vulva. This likewise is subject to considerable change in shape, being U-shaped in young females and distinctly flattened or slit-shaped in gravid, replete females. The difference is due not to any muscular action, but to the stretching of the integument consequent on engorgement.

The uterus is a balloon-shaped sac, situated in the mid-ventral line at the junction of the two oviducts. In the specimen from which Fig. 13 was drawn, the length was 1.6 mm. and the width, 1.3 mm. Its wall is formed of delicate membranous tissue, the structural units of which are small, indistinct, lightly staining cells, admixed with a few spindle-shaped muscle cells. These last are best discernible in the gravid females. On the dorsal surface of the uterus there is a deeply bi-lobed seminal receptacle, opening by a narrow, anterior end into the vagina. In size the lobes average .9 mm. by .5 mm., and there seems to be no discernible difference between their structure and that of the uterus.

The oviducts are two convoluted tubules averaging, in nongravid females 12 mm. long by .12 mm. wide. As is shown in the diagram, each tube doubles on itself twice, first running caudad to the region of the ovary; doubling on itself and retracing its course to the vagina. Here it again bends on itself, extending this time, to the ovary with which it becomes continuous. The specimen at hand indicates, and the same is shown in the drawing, that each oviduct divides to form two tubes of approxi-

mately half its diameter. These last are confluent and form the basal tissue to which the ovarian cells are attached.

The ovary is a continuation of the two oviducts and comprises the greater part of the reproductive system. Its length in non-gravid females averages 18 mm. In one gravid female, where the ovary was dissected out entire, the length was 74 mm., while each oviduct measured 45 mm. Undoubtedly, very pronounced changes must occur when the reproductive system becomes functional. In the non-gravid ovary, the primordial ovarian cells vary considerably in size, the larger ones being distributed along the dorsal surface of the ovarian tube. These large cells are sub-spherical, average .1 mm. in diameter, and possess relatively small nuclei. The smaller cells show a greater variation, ranging from .02 mm. to .05 mm. in diameter. The contents of all these cells consist of an unorganized, lightly staining yolk. In this respect they differ from the ovarian cells found in gravid females. In these last, and in the fertilized eggs, the yolk consists of deeply-staining, uniform granules, which average .03 mm. in diameter.

Besides the increase in size already noted, the fully matured, gravid reproductive tracts show other noteworthy differences. The ovary no longer presents a central tube with a peripheral, cortical layer of cells. In its place we have a long sausage-shaped sac crowded with eggs, which are identical with those in the oviducts and in the uterus. These eggs average .45 mm. in length. The nucleus, which occupied at first a central position in the yolk mass, proliferates by division, and its components migrate to one side of the egg, each investing around itself a portion of cytoplasm. In this way is developed a blastodermal disc on the ventral side of the yolk mass. Eggs in section show distinct yolk granules among which are irregularly spaced smaller, light-staining, amoeboid cells. These are most abundant in the region of the blastodermal disk (ventral plate). Eventually, these intra-uterine eggs develop a stout, transparent membrane, which is derived from the peripheral proliferation of the blastodermal cells. It is in this condition that we find the eggs along the entire reproductive tract in a gravid female. The average difference in size between these eggs and those which were newly oviposited, was .05 mm. This difference was found

due entirely to the external egg membrane which was acquired after the eggs left the oviducts and uterus, apparently within the vagina. The mechanics of this last process however, were not determined. The uterine tubes, in this gravid condition, are also subject to considerable modification. In certain parts of their course the eggs will be aggregated in clusters of a half dozen or more, while in adjacent portions the lumen will be constricted to the width of a single egg. This ability of accommodation is due, doubtless, to the large number of spindle-shaped muscle cells within their walls. The primary endothelial cells also show an increase in size and, in addition, their cytoplasm and nuclei stain more deeply, denoting possibly a variation in function. Spermatozoa (Plate II, Fig. I) can commonly be found in the seminal receptacles and along the course of non-gravid oviducts. They are elongate, spatulate cells averaging .14 mm. in length. The nucleus is located in the narrow part of the cell; is deeply staining, spindle-shaped and averages .04 mm. The shell glands of the female, and the reproductive system of the male were not determined with sufficient accuracy to warrant discussion at this time.

THE TRACHEAL SYSTEM

A well developed system of tracheal tubes (Fig. II, B) performs the respiratory function in this species. As is true of all Ixodidae, the tracheal trunks open to the exterior by two large openings, the stigmal pores, situated one on each side of the body posterior to coxa IV. Each stigmal pore is surrounded by a thick ornate plate of chitin, the stigmal plate. These last are fairly constant in structure in different species, and are therefore of considerable importance in the taxonomy of the group.

Each stigmal pore or ostium, lies within a depressed chitinized area, the macula. In *D. variabilis* the macula is situated in the antero-ventral region of the stigmal plate. It is comma-shaped, and the stigmal opening is located within its broader end. The opening appears as a crescent-shaped slit .001 mm. wide and .1 mm. long. It lies between two chitinous ridges which seemingly articulate with each other, the ventral one being immovable, while the dorsal is movable and fits into the former like a valve. Outside of the macula, the stigmal plate is thickly covered with

circular depressions of fairly uniform diameter, the so-called goblets. These average .005 mm. in width, and appear to be perforations into the inner atrium or air sac. The atrium is a shallow, membranous sac somewhat larger than the macula which it surrounds. Into its inner margin enter several large tracheal trunks. Most of these divide close to their origin into two or more branches which run to the different organs and tissues. Here they branch to form a fine network of tubules, which as a rule anastomose with a corresponding set of tubules from the opposite side of the body. In several cases it was observed (Fig. B, nos. 11 and 13) that the tubes do not form a tracheal plexus, but a relatively large tube will cross over and unite with another corresponding tube on the other side of the body. It was also observed that where ticks were permitted to drown in a stain (this being one of the devices used in studying the tracheal system) that the tracheal tubes on the left side were more deeply stained than those on the right side. The different tubes vary considerably in length and width, becoming gradually smaller as they give off branches along their courses. In structure they do not differ from the tracheal tubes of other Arthropoda. In this study an attempt was made to trace the course of each of the primary tracheal trunks and their principal branches. The accompanying drawing shows the principal trunks entering into the left stigmal plate of a male tick. They were drawn to scale, and occupy approximately their natural positions. In most cases a single tube supplies several organs, but for the purpose of this discussion only the main, definitely ascertained terminations will be included.

From ten to fifteen principal tracheal trunks open into the atrium on each side of the body. This difference arises from the fact that several trunks branch close to the atrial chamber, and it depends entirely on one's interpretation as to whether they are counted as one or more tubes. The numbering in the figure is intended to denote the different parts rather than the specific number of tubes. The brain and the anal opening were included to show the structure of the former, and to help locate the various tracheal branches.

Two of the trunks (9 and 18, Fig. II, B) are the largest, and will be designated respectively as the primary median and an-

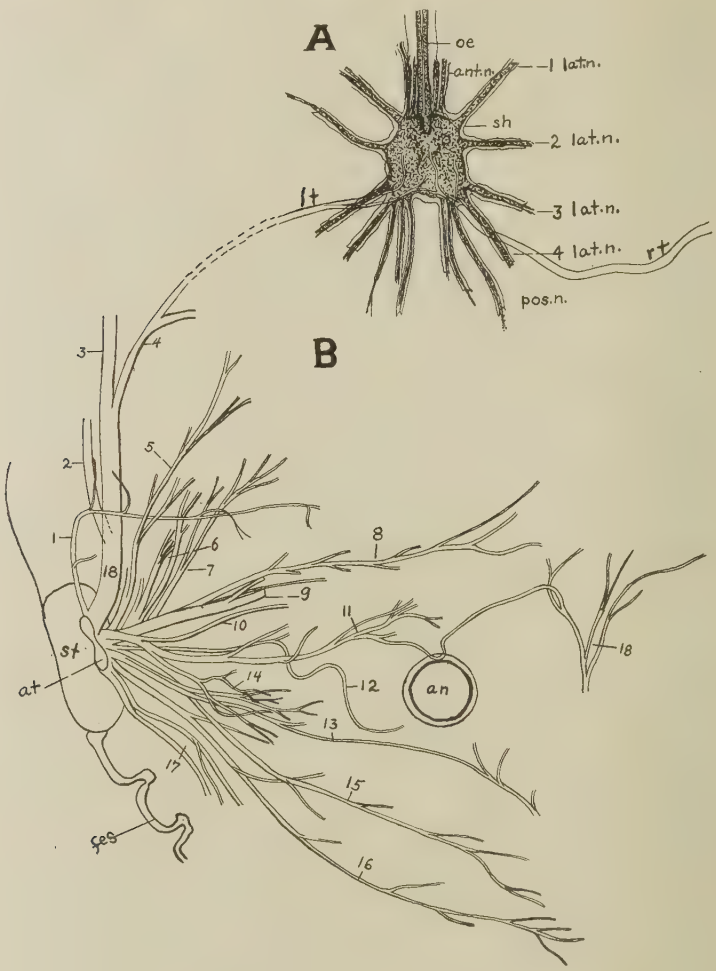


Figure 2. A. Brain of male tick showing main nerves and tracheal tubes; drawn from a stained balsam mount. × 22. B. Tracheal system of male tick showing tracheal tubes of left side of the body, and with dorsal integument removed, drawn from balsam mounts. × 30.

terior tracheal trunks. The anterior trunk runs cephalad, over the coxal muscles, and between the salivary glands and lateral hypodermis. There are two of these trunks, one on each side of the body, and they give off branches to the legs, salivary glands, brain, mouthparts and capitulum. The branches to the legs arise from the ventral surface of each main trunk, as the latter passes over the coxae. Each branch dips between the coxal muscles, giving off lateral branches to the same, and runs to the distal margin of the trochanter as a single tube. In this region each main branch divides into two approximately equal lateral branches which traverse the leg, and in turn give off one or more smaller branches into each segment. About .8 mm. from the atrium, the anterior trunk gives off a large branch (4) to supply the salivary gland, from which, in turn, a smaller branch (rt) goes to the brain. Anteriorly, this same trunk divides into two approximately equal branches, the ventral of which goes to the coxal glands and ventral integument, while the dorsal branch divides in the capitulum to supply the palps, mandibles, etc. The primary median trunk (no. 9) is narrower than the anterior trunk just described. It passes directly mesad, dividing into two smaller branches about .5 mm. from its origin at the atrium. One of these branches supplies the intestinal diverticula of the same side, while the other supplies the reproductive organs. There are of course two of these median trunks, one attached to each atrium, and the right trunk has the same distribution as the left, except that it proliferates in the intestinal diverticula and reproductive glands on the right side of the body. The structure and distribution of the tracheal tubes appeared to be the same in both sexes. To eliminate tedious repetition, the distribution of the smaller tracheal trunks will be given in tabular form. The following enumeration refers to the numbers given in Fig. II, B.

1. Small, anterior branch to intestine, reproductive system and dorsal hypodermis.

2. First branch of primary anterior trunk; to coxa IV.

3. Continuation of primary anterior trunk to anterior coxae, coxal glands and capitulum.

4. First in nerbranch of primary anterior trunk; divides into two approximately equal branches, one of which goes to a salivary gland and the other to the brain.

5. Supplies salivary glands and ventral hypodermis.

6–7. Supplies muscles of coxa IV.

8. Ventral hypodermis and intestinal diverticula.

9. Primary median trunk; supplies reproductive organs and intestinal diverticula.

10. ?

11. Supplies anal and lateral muscle bundles and integument. This is one of the tracheal trunks which crosses over and unites with a corresponding trunk of the opposite side.

12. Supplies lateral muscles.

13. ?

14. Supplies lateral muscles.

15. Supplies posterior dorsal integument.

16. Supplies posterior ventral integument.

17. Supplies muscles and integument of lateral festoons.

THE BLOOD-VASCULAR AND NERVOUS SYSTEM

The blood-vascular and nervous systems were imperfectly determined, and because of their intimate relation they will be described together. The nervous system consists of a central ganglionic mass, white in color, from which radiate outwards the peripheral nerve trunks. The central ganglion is situated at the anterior bifurcation of the mid-intestine, and is commonly referred to as the "brain." Histologically, the brain consists of a series of laterally fused ganglia, the axonic fibers of which radiate outward forming the peripheral nerves.

The main parts of the nervous system are shown in Figure 2A. This figure was drawn to scale from an original dissection of a female brain, which was cleared in xylol and mounted in balsam. When dissecting fresh ticks in salt solution, the brain is usually removed without difficulty, being suspended within a large blood-sinus by loose connective tissue, trachea and the communicating nerves. With the aid of methylen blue staining and correct illumination, these nerves could be traced for some distance under the binocular microscope. The blood-sinus is a relatively large sub-circular space measuring 0.7 mm. by 0.8 mm., the lateral axis being the longest. These measurements represent averages, and were obtained by making serial sections through this space in ten different females.

In both sexes the brain had seemingly the same structure, and varied in size from .36 mm. to .45 mm. In most cases the brain showed a slightly more triangular appearance than the specimen from which the drawing was made, the apex of the triangle pointing cephalad. Although it presents the appearance of a single structure, in reality it consists of two main parts, a dorsal and a ventral portion. The dorsal part is situated above the esophagus and is therefore termed the supraesophageal ganglion. It is only about a third as large as the subesophageal ganglion, the latter part, incidentally, giving rise to most of the peripheral nerves. As has been mentioned, each of these main parts of the brain is formed by the fusion of several lateral ganglia, the exact relation of which was not determined.

The nerves arising from the brain, leave the same by traversing the connective tissue septa between the different organs. They are closely invested with a tough sheath of simple squamous cells, which is a continuation of the investure of the brain. This sheath, seemingly, envelopes the nerves for their entire course, being absent only from the individual fibers. The supraesophageal ganglion gives rise to a single pair of nerves, which run cephalad along the dorsal surface of the esophagus. These were traced to the mandibles and to the dorsal hypodermis of the basis capituli. Paralleling these dorsal nerves there is a pair of lateral nerves which also follow the esophagus. These last were traced to the palps and capitular muscles, and unlike the former pair have their origin from the subesophageal ganglion. Both pairs of anterior nerves (ant. n.), together with the esophagus, are invested in a tough fibrous sheath, which continues cephalad almost to the margin of the basis capituli. This sheath, which is rather loose, appears to be a continuation of the blood sinus already mentioned.

Posterior to these anterior nerves, there are four pedal nerves leading from each side of the brain. Each pedal nerve innervates a single leg, and so far as could be determined they give off very few branches, and these only in the region of the coxal muscles. These lateral nerves are designated in the drawing as 1-4 lat. n., and like the anterior group, are covered by extensions of the fibrous sheath investing the brain.

The posterior or visceral group of nerves, arise from the postero-dorsal and postero-ventral margins of the brain. They are six in number and divided into two equal groups, each group emerging close to and posterior to the last pedal nerve of the same side. One pair of these nerves is larger than the others, and arises from the postero-dorsal border of the brain. It was traced, somewhat imperfectly, to the anterior convolutions of the alimentary tract. The other two pairs of nerves are smaller and emerge, seemingly, from the postero-ventral margin of the brain. Their course was followed with difficulty as they branched frequently, and were soon lost in the maze of tracheal tubes and ovarian ducts. Almost all the above determinations are based on the dissections of female ticks which were first stained in methylene blue and other dyes, then dissected in different fluids under the binocular microscope. One feature which is shown in the drawing, and which should be mentioned, is the origin and insertion of the tracheal tubes which supply the brain. These are two in number and enter the subesophageal ganglion at its junction with the fourth pedal nerves. They are rather long tubes, and arise, one on each side of the body, as secondary branches from the large anterior trunks (no. 18, Fig. I, B) in the drawing.

Aside from the blood-sinus which surrounds the brain, and which has already been mentioned, very little was determined as to the structure of the blood-vascular system. Branches extend from this central sinus, investing the esophagus and each of the pedal nerves. These sinuses are in communication with the heart, by means of a dorsal aorta situated in the mid-dorsal line, above, and paralleling the mid-intestine. The heart is located at the posterior end of the aorta, likewise in the mid-dorsal line, approximately between coxae IV. Nothing was ascertained as to the histological structure of these organs. In one male tick, which had apparently just molted, the heart and aorta were discerned very clearly. The actions of the heart were rather peculiar, as it would beat in a fast, rhythmic manner for about 45 seconds, then ceasing entirely for about 15 seconds, commencing again and repeating the same cycle. Actual timing with a stop watch of four observations, gave the following results: 16 sec. pause and 83 beats in 44 sec.; 15 sec. pause and 85 beats

in 45 sec.; 20 sec. pause and 81 beats in 40 sec.; 17 sec. pause and 84 beats in 43 sec. By carefully adjusting the light, corpuscular elements could be observed in the blood. These were driven cephalad above the mid-intestine, and by their course the limits of the different vascular structures could be determined. At every systole, the muscles of the heart and aorta were brought into sharp relief, their attachments being primarily the anterior branches of the alimentary tract. At such times the posterior branches of the antero-lateral diverticula could be observed to oscillate laterally, coinciding with the rhythmic contractions of the heart.

Conclusion

In order to conserve space for original descriptions and comment, comparisons of the writer's results with those of other workers have been purposely omitted. This does not mean that available literature was not consulted, but as it deals primarily with other species and is contradictory to a degree, it was deemed advisable to emphasize original dissections as the chief source of information. Another difficulty encountered, was the excessive synonymy employed by different authors in designating the anatomical structures of the ticks. It was frequently difficult to decide whether an author meant one thing or something else, due to the loose manner of using specific taxonomic and descriptive terms. In the present discussion only such terms were used as are accepted by most authorities. A list of references found useful in conducting this work is also included.

As this monograph is intended as a preliminary step to a more complete report in the near future, suggestions and specimens are solicited from readers who may be able to furnish the same.

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Illustrations

All drawings were made to scale by means of a micrometer disk in the eyepiece of a microscope.

Plate XII

A. Ventral aspect of nymph captured on a dog; drawn from an unstained balsam mount. × 25.
B. Dorsal aspect of hexapod larva, hatched in the laboratory and drawn from a stained balsam mount. × 55.

Plate XIII

A. Salivary glands of female. × 10.
B. Ventral aspect of palp of female. × 75.
C. Ventral view of egg after blastoderm has partly formed. × 35.
D. Side view of twelve day old egg, showing gastrulation and Malpighian tubules. × 35.
E. Dorsal aspect of egg 20 days old showing yolk sac and Malpighian tubules. × 40.
F. Same egg as E. from ventral aspect: 1, mandibular and palpal lobes; 2, capitulum; 3, leg folds; anl, anlage of fourth pair of legs; 4, yolk sac.

G. Reproductive system of female, drawn from stained balsam mount × 7.
H. Rectal diverticula of male tick from ventral aspect; drawn from unstained balsam mount. × 25.
I. Mature spermatozoon from seminal receptacle of female. ×350.
J. Digestive tract of replete female, dissected out in salt solution and drawn from balsam mount. × 2.

Plate XIV

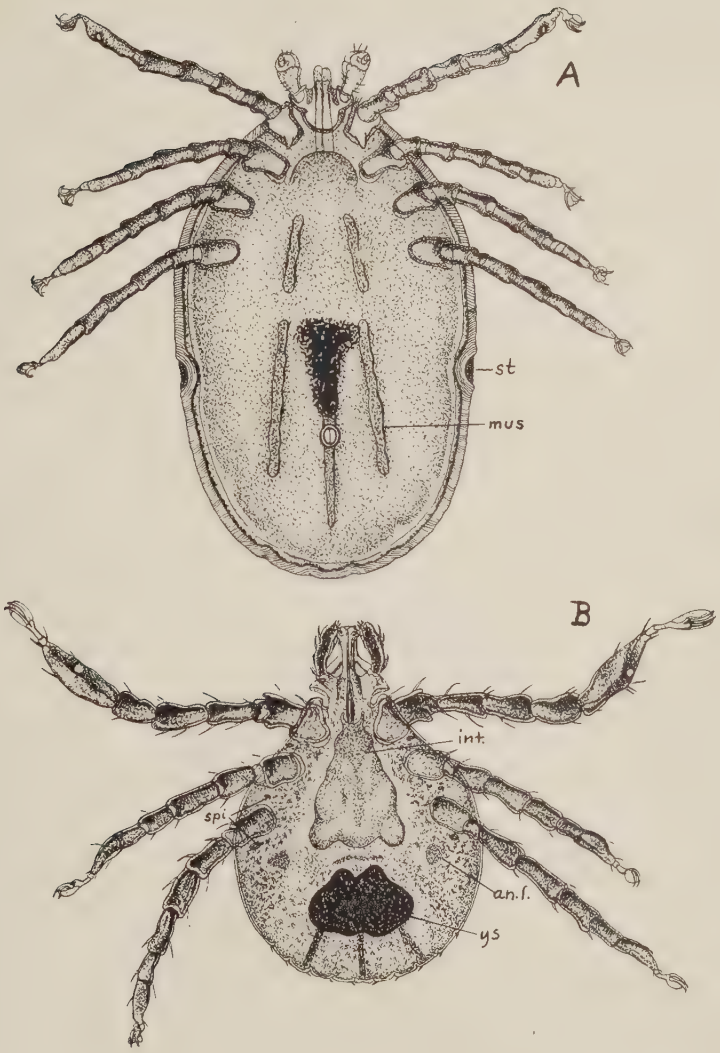
A. Hypostome of newly hatched larva. × 500.
B. Right mandible of newly hatched larva. × 900.
C. Dorsal aspect of female capitulum removed from cephalothorax and with palps missing. × 35.
D. Hypostome of female. × 100.
E. Hypostome of male. × 100.
F. Denticles from proximal surface of mandibular sheath. × 1000.
G. Denticles from distal surface of mandibular sheath. × 1000.
H. Lateral aspect of male capitulum. × 25.
I. Digit of male. × 300.
J. Digit of female. × 225.

ABBREVIATIONS

a.b. ..... anterior branch.
a.g. ..... accessory gland.
al. ..... alveoli.
a.l.d. ..... antero-lateral diverticulum.
an. ..... anus.
an.l. ..... anlage of fourth pair of legs.
ant.n. ..... anterior nerves.
ar.s. ..... articular sheath.
art. ..... articles.
at. ..... atrium.
a.v. ..... anal valve.
b.c. ..... basis capituli.
b.ca. ..... buccal cavity.
bl. ..... blastoderm.
c. ..... cornua.
ca. ..... capitulum.
clo. ..... cloaca.
cor. ..... corona.
cx. I ..... coxa I.
cx.m. ..... coxal muscles.
cx.s. ..... coxal spur.
dent. ..... denticles.
dr. ..... dorsal process.
ds.d. ..... distal denticles.
ex.b. ..... external branch of posterior diverticulum.
ext.art. ..... external article.

ext.t. . . . . extensor tendon.
f. . . . . fungus.
fes. . . . . festoons.
flex.t. . . . . flexor tendon.
g.a. . . . . genital aperture.
g.g. . . . . genital groove.
h.i. . . . . hind-intestine.
hy. . . . . hypostome.
in.b. . . . . internal branch.
int. . . . . intestine.
int.art. . . . . internal article.
lat.n. . . . . lateral nerves.
l.b.s.d. . . . . lobular branches of salivary duct.
l.m. . . . . left Malpighian tubule.
lob. . . . . lobule.
l.s.d. . . . . left salivary duct.
l.t. . . . . left tracheal tube.
m. . . . . mandible.
m.b. . . . . median branch.
m.i. . . . . mid-intestine.
mo. . . . . mouth.
m.s. . . . . mandibular sheath.
m.t. . . . . Malpighian tubule.
mus. . . . . muscles.
n. . . . . nucleus.
oe. . . . . esophagus.
ova. . . . . ovary.
ovi. . . . . oviduct.
p. . . . . palps.
p.d. . . . . posterior diverticulum.
pe. . . . . penis.
ph. . . . . pharynx.
p.l.d. . . . . postero-lateral diverticulum.
pos.n. . . . . posterior nerves.
p.s. . . . . palpal spines.
px.d. . . . . proximal denticles.
r.d. . . . . rectal diverticula.
r.m. . . . . right Malpighian tubule.
r.s.d. . . . . right salivary duct.
r.t. . . . . right tracheal tube.
s. . . . . shell.
sc. . . . . scutum.
sca. . . . . scapula.
s.d. . . . . salivary duct.
sh. . . . . sheath.
spi. . . . . spiracle.
s.r. . . . . seminal receptacle.

st.....stigmatal plate.
t.....teeth.
tr.....trochanter.
tr.t.....tracheal tube.
u.....uterus.
va.....vagina.
v.....vomer.
vu.....vulva.
y.....yolk.
ys.....yolk sac.



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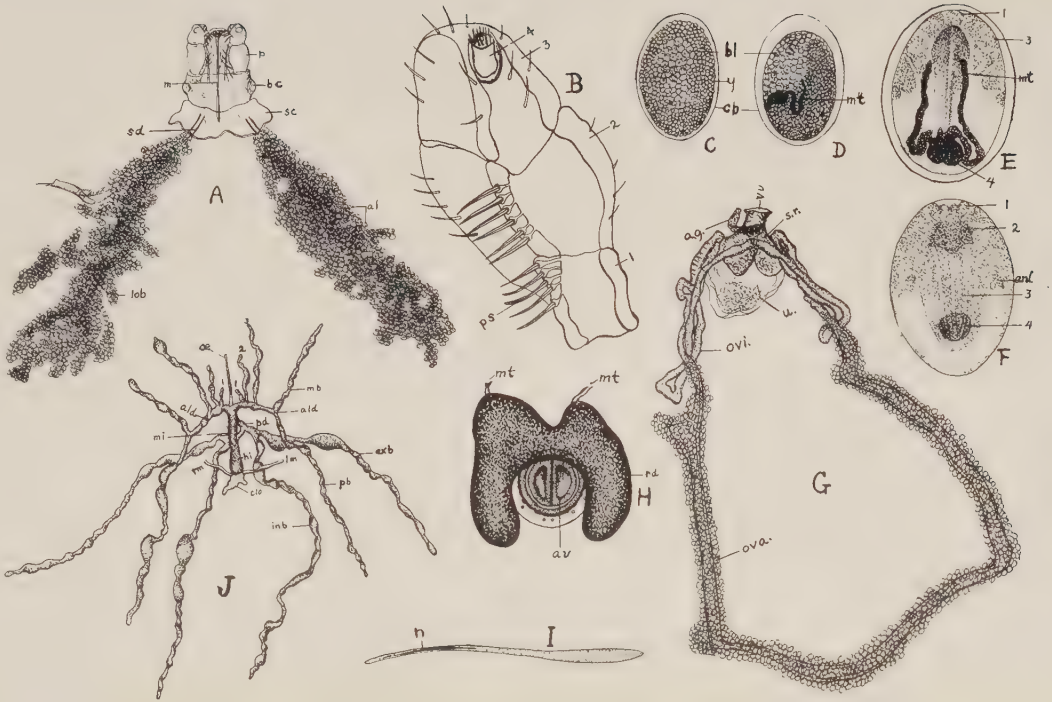

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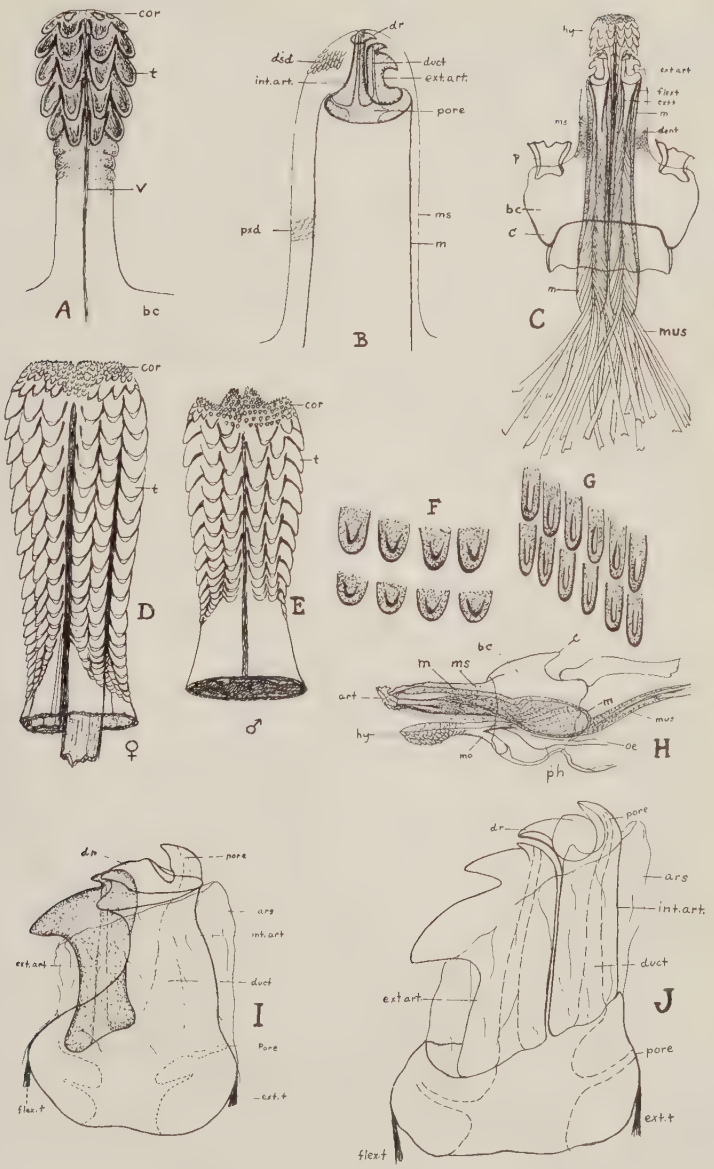

ZEBROWSKI—MORPHOLOGY OF AMERICAN DOG TICK

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TRANSACTIONS

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AMERICAN ENTOMOLOGICAL SOCIETY

PUBLISHED BY THE AMERICAN ENTOMOLOGICAL SOCIETY AT THE ACADEMY OF NATURAL SCIENCES

PHILADELPHIA

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Organized as "The Entomological Society of Philadelphia," the present title was adopted February 11, 1867.

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